THE
Emporium
OF
ARTS & SCIENCES.

VOL. 2.

CONDUCTED

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of

PENNSYLVANIA.

Philadelphia: Published by

JOSEPH DELAPLAINE

1812.

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M.L.P. Apr. 14, 1905

THE

EMPORIUM

OF

ARTS AND SCIENCES.

VOL. 2.] NOVEMBER, 1812. [No. 7.

NO. 1.

Memoir upon the Vineyards and Wines of Champagne in France: Written in answer to certain Queries circulated by M. CHAPTAL. *By M.* GERMON, *of Epernay.**

PRELIMINARIES.†

THE ancient province of Champagne, now divided into two departments under the names of La Marne and La Haute Marne, has been long celebrated as the vineyard of France.

There are two kinds of wines which distinguish this district.

White wines: called *Riviere de Marne* wines.

Red wines: called *Montagne de Rheims* wines.

The white wines are produced from vineyards situa-

* Tilloch, vol. 33, p. 75. From An. de Chim. vol. 61, p. 5.

† The numerous facts contained in this Memoir render it truly valuable: although the author expresses himself in the language of a good practical cultivator, he does not always display the accuracy of a modern chemist. We have not hitherto met with any thing more comprehensive on the subject: and it forms the materials of M. Chaptal's projected work upon "*L'Art de faire le Vin.*"—Note of the French Editor.

ted in the valleys and upon the sides of the hills in Epernay, Dizy, Avenay, Cramant, Lemesnil, Monthelon, Chouilly, Moussy, &c.: but in consequence of one of those varieties of nature, for which we cannot always account, the estate of Cumieres, in the midst of so many vineyards celebrated for white wines, and under the same exposure, produces red wines only, and of a quality far superior to the above wines.

Among all the vineyards on the river Marne, the cantons of Hautvillers, Mareuil, Cumieres, and Epernay, are the most advantageously situated: they extend along the river Marne, with this distinction, that the quality of the wine falls off in proportion as the vineyard is distant from the river: for this reason Hautvillers and Ay have always enjoyed a preference over Epernay and Pierry; and the latter over Cramant, Lemesnil, &c. and these last over Monthelon, Moussy, &c.

South exposures produce upon the banks of the Marne excellent white wines, but their declivities and posterior parts, which are called the mountains of Rheims, although situated in general towards the north, and almost always to the east, also give red wines of a good quality, and of a fine taste and aromatic flavour.

The slope which overhangs Rheims is divided according to the quality of its wines; hence we have wines of the mountain, of the lower mountain, and of the estate St. Thierry.

The mountain comprehends Verzy, St. Basle, Verznay, Mailly, Taissy, Ludes, Chigny, Rilly, and Villers-Allerand; and among these vineyards, the most esteemed are Verzy, Verznay, and Mailly. The rest, although very good, are of a different quality.

The vineyard of Bouzy, which terminates the chain or the horizon between south and east, and which, therefore, belongs to the two divisions, ought not to be omit-

ted. It produces excellent, fine, and delicate red wines, which, from its exposure, participate in the good qualities of Verznay and the good red wines of La Marne.

The lower mountain comprehends a great quantity of vineyard countries; among which we may distinguish Chamery, Ecueil, and Ville Demange: this last place in particular, when the season is good, yields wine which will keep for ten or twelve years.

The lower mountain extends to the banks of the river Aisne. As the wines it produces are of a middling quality, it scarcely requires to be particularized.

The district of Saint Thierry has taken its name, with respect to its wines and vineyards, from a large extent of grounds containing large vineyards, such as Saint Thierry, Trigny, Chenay, Villefranqueux, Douillon, Hermonville, and produce very agreeable red wines of a pale colour, very much in request by the dealers.

But the wine properly called *Clos Saint Thierry*, and coming from the archbishopric of Rheims, is the only wine which unites the rich colour and flavour of Burgundy to the sparkling lightness of Champagne. *Clos Saint Thierry* holds the same rank among Champagne wines, that *Clos-vougeot* does among those of Burgundy.

In the enumeration of the vineyards of the mountain, some readers may perhaps expect to find *Sillery* mentioned, once so remarkable for red and white wines: the truth is, that Sillery wine is in a great measure composed of the wines produced in the territories of Verznay, Mailly, and Saint Basle, once made, by a particular process, by the *marechale d'Estrees*, and for this reason long known by the name of *Vins de la Marechale*. At the revolution this estate was divided, and sold to different rich proprietors of Rheims: the senator of Valencia, however, the heir to a great part of this vineyard, neglects no means of restoring Sillery to its former reputation.

Series of questions put by M. Chaptal, with their answers.

I. *Which is the most advantageous exposure for the Vine?*

The most advantageous exposure for the vine is, without contradiction, the south and the east; but it has been ascertained that certain advantages of soil and the nature of the plant must also concur: otherwise various districts, such as Damery, Vanteuil, Reuil, &c. with the same exposure and climate, and also watered by the Marne, would enjoy the same celebrity as Cumieres, Hautvillers, and Ay. It must be confessed that the former districts produce inferior kinds of wine; but it remains to be decided whether we ought to ascribe this difference to the culture, the plants, or the soil.

II. *Are the high Exposures, the middle Elevations, or the lower Grounds, best adapted for Vineyards?*

Of all situations, the middle grounds are most esteemed: the heat being more concentrated in them, they are exempt from the variations of the atmosphere which prevail on eminences, and from the humidity and exhalations which issue from the lower regions: the elaboration of the sap or juice is therefore more complete in the middle grounds.

III. *Does an East or West differ much from a South Exposure, in occasioning a sensible difference in the Quality of the Wines?*

A western exposure is unfavourable to vegetation: it burns and parches without any advantage, nor does it give time for the juice to be elaborated, and spread through all the channels of vegetation, when mists, humidity, or dew, succeed: it is a certain fact, that there

is a difference of one third in the quality and value between vines situated in east and west exposures.

IV. *Describe the Nature of the Ground or Soil which produces the best Wine.*

Next to exposure, the nature of the soil and of the ground influences the quality of the wine. It must be admitted, however, that grounds with a northern exposure produce wines of a generous and spirituous description; while another exposure, perhaps to the south, yields a poor and common sort of wine. It is therefore to the salts and the juices of the earth, combined with the influence of the atmosphere, that we must ascribe the goodness and qualities of soils adapted for vineyards.

The most proper soil for vines is a sandy granitic earth, neither compact, nor too thick, nor clayey: frequently in the best exposures, we meet with stony soils, which give very strong wines; but warm and dry seasons are requisite in these cases, and a necessary maturity: beneath these stony soils, there are clayey and unctuous parts, and plenty of springs, which conduce to the elaboration of the juice.

In general throughout Champagne the soils proper for vines rest upon banks of chalk. The vine, indeed, comes up slowly in this kind of soil, but when it has fairly taken root it grows to perfection: the heat of the atmosphere is tempered and modified by the coolness of the chalky beds, the moisture of which is constantly sucked up by the vegetative channels of the vine-plant.

CULTIVATION OF THE VINE.

V. *How is the Vine planted?*

In November or December, when the season admits of it, the vine is planted by making an oblong hole or fur-

row, one foot and a half in depth, by two or three feet in length: the plant is introduced into it and covered with earth, sloping it in such a way as to uncover only two or three inches of the extremity of the plant, to which a horizontal and erect position is also given. Each hole of this kind is one foot and a half from the one adjoining, and on the same line in vineyards where the soil is rich; two feet being allowed in light soils. An interval of three feet is left between the rows of the plants, and care is taken when a new row is begun: the plants must not be placed perpendicularly, and directly above each other.

VI. *What is the Way in which the Shoots are made?*

The plants are inserted into turfs, or in *longuettes*. The longuette is a mere naked twig, which had been left the year preceding, and which is now carefully raised and detached, leaving the young roots behind it.

The turf plant, or *marcotte*, consists in digging up a turf in the marshes, and introducing into it in spring, by means of a hole made in the middle of the turf, the *longuette* or slip intended to be planted: this shoot with its earthy appendage is then fixed in the ground, sloping it as usual: the root is formed in the course of the year, and with a pruning-knife the longuette is cut close to the top of the shoot, and they are then removed by men, or on the backs of animals, in order to be afterwards planted: this last way is the most expensive, but it is the surest, and advances the vine very fast in respect to vegetation.

One hundred of longuettes or bare slips cost four or five livres, and turf plants cost from 12 to 14 livres.

But as two longuettes are requisite for each hole or furrow, when they plant in this way there is a trifling saving, although the other method is far preferable.

VII. *Is Grafting advantageous?*

Grafting is not in general use, except in the vines belonging to the vine-dressers themselves, and in the large plant: these vines when grafted become yellow, and languish. The graft remains for some years exposed to the air, humidity, and to bad management of the labourer, and in short to all the intemperance of the climate.

VIII. *How long does a good Vine Plant last?*

A good vine plant lasts 50 or 60 years, and frequently longer, according to the care which has been taken of it.

A vine plant is deteriorated generally by the bad management of the vine-dressers with respect to the shoots or slips: if they are not sunk deep enough in the ground, the vine plant becomes overwhelmed with roots, which at last form a solid cake, and absorb all the juices from the ground: the vine being thus incapable of shooting, the evil ought to be instantly remedied.

IX. *What Kind of Grapes are best adapted for White Wine?*

Black and white grapes are planted indiscriminately in the same vineyard: and this is perhaps wrong; for the term of maturity is not the same with both kinds of grape. The reason assigned for this practice is, that wine made from black grapes alone would be too vinous, and would become muddy (*sujet á tacher*) in hot seasons; while wine made from white grapes would be too soft: the latter kind of grapes would be too soft, as containing more mucilage (*muqueux*).

X. *Is the Black Grape preferable to the White?—State the Cause of this Superiority.*

There is not much variety in the grapes of Champagne.

The black are generally preferred to the white grapes for several reasons: In the first place, the black grapes resist much better the rains and frost so common about vintage time. Secondly, because there is more vinosity and fineness in the black grape, and it gives more of what is called body to the wine: the white on the contrary is too mucilaginous, renders the wine soft, and exposes it to become yellow, or to thicken.

There are whole cantons, however, such as Chouilly, Cramant, Avise, Bisseuil, &c. where there are but very few black grapes, and yet their wine is in high estimation.

XI. *Which of the Exposures is most subject to the Hoar-frosts of Spring?*

The effects of frost are only to be feared at sunrise: the eastern exposures are consequently most apt to suffer, although it has been ascertained that vine plants freeze in every exposure.

Thus, all the preservative methods hitherto indicated, such as fumigations, or poles armed with long branches of foliage capable of being agitated by the air, are mere reveries of the imagination: they have been employed indeed in small enclosures; but they never preserved a single cluster of grapes, and are incapable of being applied to a large vineyard.

XII. *At what Period is the Vine to be pruned?*

About the end of February or beginning of March, the most essential operation must be performed, namely, that of cutting the plant. When it is very strong, two branches or stumps only are left.

XIII. *How many Eyes are left in the Plant?*

Three eyes upon each branch: when the vine is weak, one branch only is cut off.

XIV. *At what Height from the Ground is the Plant pruned?*

When the plant is young and the rind is not marked with old prunings, the plant is cut at the height of three or four inches: the vine-dressers cut higher, because they frequently cultivate three branches, and leave four eyes.

XV. *To what Height is the Vine allowed to rise?*

Not higher than a foot and a half,—to avoid dilating the sap too much.

XVI. *At what Season does the first Operation in the Vine-yards commence?*

After having pruned the vine, the first occupation is that of hoeing: this operation consists in digging up the earth around the plants, so as to uncover their roots for a moment, and detach the earth from them which may have become clotted; the hoe being always inserted into the earth about a foot from the plant.

At the end of March, or beginning of April, when the thaws have softened the ground, the hoeing commences.

XVII. *What is the Period of Planting by Slips or Cuttings.*

This kind of planting is performed at the time when the vine is planted.

XVIII. *In what Manner is this Kind of Planting managed?*

In pruning, the vine-dresser reserves, in the barest and most sterile places, certain slips, upon which he leaves only two or three stalks, according to the strength of the slip: the hole or furrow being made, the slip is gently inclined, by disengaging the roots, and by means of a pair of tongs the stalks are held while placing in the furrow,

at from four to six inches distance from each other: the slip being thus fixed at the depth of a foot or thereabout, a hand-basketfull of manure is thrown at the root of the slip; the hole is then filled up with natural earth in a loose manner, in order to admit of the two or three stalks sending out their shoots without being bruised.

XIX. *How many Operations are there to be performed between the Pruning and the Vintage Season?*

The prunings being over, as the same vines are not pruned every year, and even in those which have been pruned the earth has not been thoroughly stirred, the vines are trimmed at the beginning of May: this trimming is called *labourage au bourgeon*, and is followed by the tyeing up of the vine plants.

XX. *Which is the most favourable Moment for Tyeing and Paring the Vine?*

While the vine is in flower, it must not be touched: it must be pared when the flower has nearly passed away, and at the height indicated in Art. XV.: it must afterwards be tied in such a way as to envelop the slip, without injuring the circulation of the air or the growth of the suckers.

Finally; about the middle of August, in order to clear away the grass from the roots of the plant, and to raise up the grapes which may have fallen to the ground, a third and last trimming takes place.

The following is the routine practised in the vineyards of Champagne:

1. They are cut in February or March.
2. Hoed in March.
3. Pruned in April and May.
4. Tied or propped up in April and May.
5. First trimming for the shoots.

6. Pare and tie in June.
7. Second trimming in July.
8. Third trimming in August.

XXI. ***How is it ascertained that the Grape is sufficiently ripe, in order to commence the Labours of the Vintage?***

At the end of September, or later if the season has been backward,—before proceeding to the labours of the vintage, in order to obtain the fruit at the most complete state of ripeness,

The stalk of the grape must be brown and woody;

The grape pendent;

The skin or pellicle of the grape tender, and not brittle when chewed;

When a seed can be easily detached from the juice of the grape:—which should in its turn present a vinous and transparent appearance, without having any green in it;

When the grape stones are brown, dry, and not glutinous.

OF THE VINTAGE.

XXII. ***What Precautions are necessary for managing the Grapes so as not to injure the White Wines?***

Many precautions, even of detail, are necessary in making white wine.

These consist in carefully picking the ripest and soundest grapes from all withered or bruised grapes; they are then put into panniers, and covered with cloths to prevent the effects of the sun's rays, and to avoid fermentation.

The panniers thus covered, being put upon the backs of horses, are conveyed to the press; into which they are not emptied, however, until after sun-set. From twenty to forty panniers full are put under the press at a time:

the contents of two panniers produce half a piece of wine: forty panniers yield nine or ten pieces of white wine, and each piece contains two hundred bottles.

(To be continued.)

No. 2.

XXI. *Account of a Descent into the Crater of Mount Vesuvius by eight Frenchmen on the Night between the 18th and 19th of July 1801.**

TO ascend to the summit of mount Vesuvius, which is elevated 3600 feet above the level of the sea, is an enterprise of great difficulty, as it is necessary for nearly half the height to climb an exceedingly steep declivity up to the knees in ashes. Some philosophical men of eminence, however, as Spallanzani, Dolomieu, Dr. Moore, &c. have overcome all these difficulties. Sir William Hamilton, who caused a great many views of Vesuvius to be designed during his long residence at Naples, ascended to the summit of it sixty-two times; but no one, at least since the eruption in 1799, ever ventured to descend into the crater of this volcano, not even Sir William Hamilton, who considered it under so many points of view, and who visited it so many times. It was reserved for eight Frenchmen to hazard this dangerous enterprise, and to succeed in it completely, notwithstanding the timidity of their guides, the impossibility which the Neapolitans attached to it, and the instances they mentioned of rash travellers who had lost their lives in the attempt, and been swallowed up by the volcano.

To be able to appreciate the danger of this enterprise, it will be necessary to have a correct idea of the form and position of Vesuvius, and of the matters which it

* Tilloch, vol. ii. p. 134.

throws up. This volcano has the form of a truncated cone, and a part of its base, which is altogether three leagues in circumference, is washed by the Mediterranean; its mouth, or upper base, which is a little inclined to the axis, is 5722 feet in circumference. The earth from the base to half the height consists of vegetable mould mixed with lava and stones which have not been attacked by the fire, tufas, pumice, and calcareous stones, different in their nature and colour according to the different degrees of impression which have been made on them by the fire.

The half of the height next the summit is composed chiefly of pure ashes, but coarser than our common ashes. Till the present time, there have been twenty-four eruptions recorded in history. The first took place in the year 79 after the christian era: by these eruptions volcanic matters have been successively accumulated, but by that of 1799 the situation of the crater and of the aperture was entirely changed. The focus or crater is now sunk 200 feet below the upper edges of the mouth of the volcano.

To arrive at the crater, and to observe the numerous spiracles, long crevices, and fires which issue from them in several places, and also the variegated and still smoking matters of which the crater is composed, it was necessary to pass over this space of 200 feet.

The inner sides of the volcano are nearly perpendicular, or exceedingly steep, and composed of ashes, lava, and large calcareous stones; but these lava and stones, as they form no connection with the ashes, cannot serve as any point of support; and when any one is so imprudent as to adhere to this kind of rock, the least motion, the least displacement of any part, makes the whole crumble to pieces. Besides, from the summit of Vesuvius to the crater, the declivity, being exceedingly rapid, cannot be traversed but on all fours, and suffering your-

self to glide down amidst a torrent of ashes and lava. But the most dangerous obstacles are those awful excavations, which cannot be passed over without great trouble and difficulty.

Disregarding the terror with which the Neapolitans endeavoured to inspire us, after having received their adieus, as if our separation had been likely to be eternal, we set out in a carriage, at half after eleven at night, on the 18th of July, from the hotel of the French ambassador, fourteen in number, furnished with ropes and other articles which we supposed might be necessary, and all in a state of the highest spirits, which never forsook us, even at times of the most imminent danger. We arrived about midnight at the foot of Vesuvius; and, having quitted our carriage, mounted well experienced mules, and proceeding one after the other, with adjutant Dampierre at our head, amidst the thick darkness of night, reached half way to the steep summit of the mountain. We had a numerous body of guides, and their lighted torches gave to our expedition a mysterious and solemn air, which formed a striking contrast with the mirth and gaiety of the company.

When we had ascended about half way, we were obliged to alight, and to clamber up the steepest and most difficult part of Vesuvius, wading through the ashes up to the knees, till, exhausted with fatigue, and covered with sweat, we reached the summit at half past two in the morning.

The first thing that struck us as soon as the morning began to dawn, was a most magnificent spectacle—a superb view of the city and port of Naples, the beautiful hills which surround them, and the vast extent of the sea by which they are washed. After walking round part of the aperture of the volcano, that we might choose the most commodious place for descending, adjutant Dam-

pierre and C. Wickar first descended, without any accident, at the determined point. When they had got about a third of the way they were suddenly stopped by an excavation of fifty feet, which it was necessary to pass. As they found that it was impossible to obtain any fixed point of support on ashes so moveable; and being convinced that the friction of ropes would have soon destroyed both the point of support and the neighbouring masses to a great distance, they resolved to return. Besides, while deliberating on the means of descending, some stones rolling down from the summit occasioned a general agitation wherever they passed: adjutant Dampierre found the ground on which he stood shake beneath his feet; and he had scarcely quitted it, calling out to C. Wickar to follow him, when it disappeared. Soon after, indeed, the whole space where they had stood, and all the neighbouring small eminences, crumbled down successively in the course of half an hour, and were precipitated to the bottom of the crater with an awful noise.

Before we renounced our enterprise to return to Naples, dejected on account of not having succeeded, we once more walked round the mouth of the crater, and at last discovered a long declivity, pretty smooth though very steep, which conducted to the focus. Without examining the precipices which it might be necessary to pass before it could be reached, C. Debeer, the ambassador's secretary, accompanied by a lazzaroni, set out first to attempt the passage. When they had got half way, amidst a torrent of ashes, which the impression of their feet made to roll down along with them, they found means to fix themselves on the edge of a precipice twelve feet in height, which it was necessary to pass before they could reach the lower declivity. The lazzaroni, frightened, refused to proceed; but, being promised a double ducat, avarice got the better of his timidity; he speedily made

the sign of the cross over his whole body, and, having invoked the Madonna, and St. Anthony of Padua, threw himself along with C. Debeer to the bottom of the first precipice: soon after they arrived at another, but being of less height it was passed with more ease. At length, amidst a continual torrent of falling lava, ashes, and stones, they arrived at the bottom of the crater, and stretched out their arms to us, sending forth shouts of joy, which we returned with the utmost satisfaction and enthusiasm.

C. Houdouart, engineer, immediately followed C. Debeer; and after encountering the same difficulties, and passing dangerous precipices, joined him at the bottom of the crater. Being there both convinced of the almost insurmountable difficulty of ascending, they threw themselves into each other's arms, like two friends reduced to the necessity of terminating their lives together in a desert island without any hopes of escaping from it.

They then began, but with cautious steps, to walk round this immense furnace, which still smokes in several places. The intrepid Wickar, who was very desirous to participate in their fate, called out to them to send some one to assist him in passing the two cliffs; but seeing no one coming, and growing impatient, he rushed forward, and rolled down towards them amidst a torrent of stones, ashes, and volcanic matters. Adjutant Dampierre, C. Bagneris, physician to the army, Fressinet and Andras French travellers, and Moulin inspector of posts, soon followed, and arrived at the crater after having incurred the same dangers.

Wickar immediately sat down on a heap of scoriæ, and, with that superiority of talents for which he is distinguished, sketched out in profile, with a perfect resemblance, the portraits of the eight Frenchmen who had descended. Each then formed a small collection of the

different volcanic matters which appeared to be new or curious, and endeavoured to make a few observations.

Had we been allowed to depend on success, had we not been retarded in our preparations by our timid guides, and if some of us, having only just arrived at Naples, had not been straitened in point of time, our descent would certainly have been much more useful, and the results more satisfactory. However, though ill furnished with means, the following are the observations we were enabled to make:

Reaumur's thermometer, the only instrument we possessed, stood at 12 degrees, on the summit of Vesuvius: the air was cold, and somewhat moist: in the crater the quicksilver rose to 16 degrees, and we experienced the mildest temperature.

The surface of this place, which, when seen by the naked eye, looking down from above, appeared entirely smooth, exhibited, when we were at the bottom, nothing but a vast extent of asperities. We were constantly obliged to pass over lava exceedingly porous, in general pretty hard, but which in some places, and particularly those where we entered, was still soft, and yielded under our feet. The spectacle which struck us most was the numerous spiracles, which, either at the bottom of the crater or the interior sides of the mountain, suffer the vapours to escape. When we arrived at the crater, we were desirous to ascertain whether these vapours were of a noxious quality: we walked through them, and inspired them several times, but felt no inconvenience from them. The thermometer placed in one of these spiracles indicated 54 degrees, in another it rose only to 22. In all these experiments our instrument was covered with a humid matter, which was soon dissipated in the open air without leaving any traces.

In traversing the surface of the crater, we perceived a focus half covered by a large mass of pumice stone, and which, from its whole circumference, emitted a strong heat. The thermometer placed at first at the entrance of it, and then immersed to as great a depth as the nature of the ground and the heat would admit, never rose higher than 22 degrees. This singularity surprised us, but we were not able to explain it.

The volcanic productions which we observed in the whole crater were lava, exceedingly porous, and which the fire in certain places had reduced to scoriæ. It was of a dark brown colour, and sometimes reddish, but it is rare to find any white. The substances nearest the spiracles are all covered or impregnated with sulphur. This mineral is found very often in a state of oxygenation. It is sometimes white, and sometimes of a yellowish colour, and the sharp and pungent impression it leaves on the tongue sufficiently indicates the state in which it is. The burning focus, of which we have spoken, produces the same results. Some basaltic lava is also found, but in small quantity; one specimen only, of a considerable weight and beautiful polish, attracted our attention.

On the north side of the crater there are two large fissures, one of which is 20 feet in depth, and the other about 15. They are shaped like an inverted cone. The matter with which they are covered is entirely similar to that on the rest of the surface. They emit neither smoke nor heat; yet some sulphurous productions plainly show that the fire in these places has not long been extinct.

When we had finished these few observations, it was necessary that we should think of returning. The descent is far less laborious than the ascent; for it is difficult to climb eminences where the points of support are so moveable. Besides, people cannot ascend but one at a time in succession, after long intervals, for fear of bury-

ing under a torrent of volcanic matters those who follow, as the foot, when moved, displaces the ashes, &c. to the distance of thirty feet round.

When we arrived at the two precipices, we were obliged to ascend by mounting on the shoulders of a man placed at the bottom, and laying hold of a stick held by another at the top, and to rest our feet no where but in a very gentle manner. At length, by prudence and caution, we reached the summit of Vesuvius without any accident, but exhausted with fatigue, and so covered with ashes and smoke, as to be scarcely distinguishable. Our six companions, who had not descended into the crater, were overjoyed when they saw us again, and supplied us with some refreshments, of which we had great need.

When one grand difficulty is surmounted, inferior ones are overlooked, as of little importance. In less than twenty-five minutes we again descended, having confirmed, after examining various stones, this observation, that Vesuvius is the only known volcano which throws up from its bowels primordial substances, without being altered by the fire, and such as are found at present in banks and veins.

At half after eight in the morning we arrived at Portici, the inhabitants of which were much surprised to see us return all safe. Their delicious fruits, and their excellent wine called *lacryma Christi*, soon made us forget our fatigue, and we then proceeded to Naples, which we reached in safety.

The result of this excursion, which was only an experiment, can be of no further use than to show the possibility of reaching the crater, and to open the way to it to philosophers, naturalists, and chemists, who, by exploring this immense furnace of nature at their leisure, will find a variety of matters which will afford an ample field for the application of their chemical knowledge, and may

enable them to make discoveries interesting to the arts and the sciences.

The names of the eight Frenchmen, in the order in which they descended, are as follow: Debeer, secretary to the ambassador Alquier; Houdouart, chief engineer of bridges and causeways attached to the army of Italy; Wickar, painter; Dampierre, adjutant-commandant; Bagneris, physician to the army of observation; Fressinet and Andras, French travellers; and Moulin, inspector of posts.

NO. 3.

Description of the Valve Siphon of the late Mr. AMI ARGAND, *Inventor of the Lamps with a Double Current of Air.**

(With an engraving.)

THIS improvement, though simple, is ingenious, and particularly adapted to large siphons, that require to be removed from one vessel to another. A valve, as E, or H, pl. I. fig. 2, is applied to the foot of the shorter or ascending leg of a siphon AB, BC, at the other foot of which a stop cock F is placed. The cock being open, and the foot E immersed in any liquid in a vessel IK, by moving the leg E perpendicularly downward and upward, the liquid will gradually ascend through the valve E, till it runs out at the point L. The pressure of the air on the surface I will then be sufficient, to force the liquid through the valve E, as long as this remains beneath it; and thus

* Nicholson, vol. xviii. p. 61. From Sonnini's Bibliothèque Physico-économique, Nov. 1806, p. 117.

it will continue to act as a common siphon, and the vessel will be emptied, unless supplied from some reservoir, as N.

As soon as the siphon is filled, and begins to discharge the liquid at L; or at any period while it continues full; if the cock F be turned so as to stop it, it may be very safely and conveniently removed to any other vessel; as the cock will prevent the liquid from running out at one end, and the valve at the other: and the moment the extremity E is immersed in the liquid in another vessel, and the stop cock F turned, it will act again as before.

The siphon may be filled in this way in a clear liquid, and then removed into a vessel of the same kind of liquid, that has a sediment at bottom, which would be disturbed by moving it up and down. This however may not always be convenient: Mr. Argand therefore makes an aperture with a short perpendicular tube O in the horizontal branch BB, through which, by means of a funnel, D, the siphon may be filled, while the cock F is shut; so that it may be inserted into the liquid, and made to act without disturbing it. When the siphon is thus filled, or when the funnel D is not required, the aperture at O is closed by the stopple G.

For the convenience of carrying the syphon, as well as for packing it up, or cleaning it, the horizontal and perpendicular branches are made to take asunder at the joints MM. The nozzle L is likewise made to take off, as it is frequently more convenient for the fluid to be drawn off perpendicularly.

No. 4.

Observations on the Various Uses to which the Sunflower may be applied. By the Editor.

THE advantageous employment of this plant does not appear to have been sufficiently appreciated. The object of this essay is to attract the attention of those who may have it in their power to pursue the enquiry to its full elucidation; and it is expected, that this may be readily accomplished by persons residing in the country, with little expense or trouble to themselves, and with real benefit to the community, if their experiments shall satisfactorily demonstrate the presumed merits of this very common and luxuriant product of the vegetable kingdom.

In a letter, published in the first volume of the American Philosophical Transactions, from Dr. Otto of Bethlehem to Dr. Bond, we have an account of the oil produced "from the seeds of the common large sunflower," by methods very similar to the extraction of linseed oil; one bushel of the seeds yielded about three quarts of oil; and he states that it was frequently used on sallad, for which it answered very well. The committee, to whom the specimen sent was referred, report it to be thin, clear, and agreeable to the taste, and are of opinion, that it "will supply the place of olive oil for the above, and many other purposes; and may, therefore, be looked upon as a valuable discovery to America.

Immediately following this communication, is an essay by Dr. J. Morgan, "on the expressing of oil from sunflower seed," in which we are informed, that it is found from experiments, that a bushel of the seeds will yield, on expression, near a gallon of mild oil. And he gives the account, from a correspondent at Lancaster, of certain results upon this subject, from which we learn, that

one hundred plants, set about three feet distant from each other, &c. " will produce one bushel of seed, without any other trouble than that of putting the seeds into the ground, from which he thinks one gallon of oil may be made." " By an estimate made, it appears, that one acre of land will yield to the planter between forty and fifty bushels of seed, which will produce as many gallons of oil." The remainder of the essay is taken up with many valuable observations on the mode of expression, and on other points connected with the subject, which are unnecessary to be here transcribed, since the whole of the original communication will be advantageously read, by any one who finds an interest in the present essay.

Mr. John Saunders, of Gloucestershire, (England) has called the attention of the public, in Dickson's Agricultural Magazine, No. 6, to "the use of the seed of the great sunflower,-(Helianthus annuus) as a food for swine, rabbits, poultry, &c." in which communication he reckons that an acre will produce from fifty to sixty sacks, (weight of sack not mentioned,) the profit of which, at the low rate of two shillings and sixpence per sack, is estimated at four pounds sterling per acre. He remarks likewise that the stems partake so much of the nature of wood, that, when perfectly dry, they may be burnt as fuel, an acre affording from three to nine waggon loads. He suggests also their use by wattling and other modes, to enclose sheep, and to guard them from the inclemencies of the weather; and that, where there are dry walls, with the aid of rafters and hurdles, they might be converted into an excellent covering for temporary sheds in the fields, and about the homesteads, for pigs and other animals. He recommends the leaves as an excellent green food for rabbits, or as serving for litter when dried. The plants, too, he affirms, will remain a long time after they are ripe, without shedding their seeds, through

neglect of gathering, and are not liable to be injured by rains, or destroyed by the attacks of birds. He mentions the cultivation of the plant in France for the sole purpose of extracting an oil; and he recommends sowing the seeds very early in the spring, if not in December, as the early sown plants always arrive at the greatest height, and produce the largest quantity of seeds. The whole paper is worthy of perusal.

The mode of culture is given in the same magazine, No. 7, by "Amicus," from Dr. Willick, and Mawe and Abercrombie's Gardener's-Calendar. This person states the use of the oil in *printing*; and of the *cake*, after expression of the oil, in feeding a pair of small oxen, who eat it greedily, and throve well upon two pounds a day. He further states the oil to be as fine transparent sweet oil as ever was produced from almonds: and that eighty pounds weight of clean seed produced eight quarts of oil, part of which he used in lamps, and found it burn with great pureness and brilliancy.

In No. 9 of the above mentioned magazine, a writer conceives, that it may be successfully cultivated for the purpose of supplying clothiers with oil, instead of using the Florence oil imported from the Levant, and which is sold to them when it becomes rancid, for the purpose of softening their wool, when preparing for the loom.

We have another writer on the subject in the 27th No. a Mr. John Wright, who estimates the crop produced by him at not less than twenty quarters of seed to the acre; though he considers it a tedious crop to harvest, from its ripening at so many different periods: he nevertheless appears to think well of it upon the whole.

I have thus collected a mass of facts, which altogether, I think, render this plant worthy the attention of the farmer, and afford adequate encouragement to a fair trial of its real importance, in affording a most important article

to the painter, printer, clothier, and in domestic economy, both as a fuel and for diet. I come now to what, I trust, may prove of far more value in a national point of view; I mean the great strength and staple of the woody fibre of the stalk of the sunflower, a part not heretofore applied to any use, except as above proposed by Mr. Saunders.

When we consider the immense importance of the article hemp to our maritime concerns, (other objects of its application out of the question,) and recollect what sums are annually expended in Russia in the purchase of this raw material; when we reflect, too, on the comparatively small proportion of our wants supplied amongst ourselves, partly arising from the trouble and uncertainty of the crop, and more, perhaps, from other articles of husbandry being more productive; we must admit, that if a fair and adequate experiment shall prove, that a plant, attended with little trouble in cultivation, and almost certain in its produce, is capable of affording a substitute for hemp, of equal or even superior strength for manufacturing ropes, cables, &c. of such infinite importance to the commerce, &c. of the United States;—I say, if this is demonstrated by fair experiment, who will doubt its becoming an article of the first attention in agricultural pursuits? The chief object of this essay is to call upon our farmers and others, especially those who are accustomed to raise hemp, to give this a fair and candid examination. In towns, we have not adequate advantages to pursue this enquiry; but it is now several years since I accidentally found a sunflower standing in my garden, of which little remained but the woody fibre, (the rain, &c. having gradually rotted off the epidermis, &c.) which resisted so much my attempts to break it, that I was forcibly struck with the probable advantages to be derived from its use. Since that time I have repeatedly mentioned the fact, and have endeavoured to induce others to pursue the en-

quiry, but, I believe, without effect. My attention has been again called to this subject, by lately stripping off a small and single fibre from a plant, and twisting it once or twice into a small twine, which I could not with all my force break, otherwise than by repeatedly bending, so as gradually to destroy the cohesion of the parts; even the *single* fibre would, I believe, have supported a weight of some pounds. Under the impression I have, I consider the medium of the Emporium the best, by which I might hope to have a full and fair experiment made upon a point so truly important, and I have only to request the favour of any one who pursues it, to let me know the result, that I may communicate it to the public.

Before I conclude, I shall only add, that the *pith* of this plant, which is very considerable, is, without exception, one of the most combustible materials I know. A piece of seven or eight inches in length, from one of the branches, perfectly dry, catches fire like tinder, and burns down in less than a minute. Whether experiment may show it to be useful as a match, in blasting rocks, instead of the present kind employed, I know not; probaby we may find it useful in this, as well as in other pursuits.

JOHN REDMAN COXE.

Philadelphia, October 5, 1812.

NO. 5.

Description of a New Machine for Raising Water to any height. By I. B.

(With an engraving.)

Baltimore, August 25, 1812.

SIR—If you think the machine, of which I send you the description and sketch, deserving any merit on account of

its simplicity, you are welcome to make it public by means of the Emporium. Though both the principles of it are old enough, yet I never have seen them combined before.

I. B.

DR. COXE.

AB (plate I. fig. 1.) is a box made of thin planks, which, together with its two tubular arms BC and BD, is moveable about the centres G and H. At the extremity of each arm is a hole, as E, of such a size that the quantity of water discharged by both, shall be less than that which falls through MN: the tube AB will therefore be constantly full. H is the axis of the whole, fastened to the interior of AB. At I is a *perpetual joint*, with the upper axis of which is connected the cylinder ST, with a tube coiled round it, so as to form a screw of Archimedes. The cylinder is prevented from slipping downwards by a shoulder on its axis at *a*, and is moveable on the centres *a* and *b*.

The action of the machine, which is easily understood, is as follows: The water flows through RP, which is connected with the stream by means of a pipe, into the box X until it fills it as high as K. It then continues its course through the tube KLMN, and falls into the box AB. As the holes E and F discharge less than the quantity of water which flows into AB, it will soon become full, when the water rushing out at the two holes will cause, by its reaction, the arms, and of course the box AB, to move in a retrograde manner. The axis H revolving also turns the cylinder ST, at every revolution of which the orifice of the pipe *c* descends into the water X, takes in a small portion, and as the whole turns, raises it gradually to the top, where it is discharged at U, and carried off by the pipe W.

The cylinder may be prolonged to any height desired, but it is evident that the longer it is, the smaller must be

the diameter of the tube, in order that the same force may move it in both cases.

No. 6.

On Rail-Roads. By a Correspondent.*

To Mr. Tilloch.

Sir—As the proposed rail-way from Sanquhar to Dumfries has of late been the subject of some conversation, it is hoped the following short account of that useful invention will not be unacceptable to some of your readers.

I am, sir,

Your most obedient servant,

X. Y. Z.

Dumfries, July 2, 1811.

Rail-ways are roads of very easy inclination, having cast iron rails, on which waggons, with wheels adapted to those rails, move.

These rails are usually about three feet long, and are rested at each end on stone, wood, or cast iron.

The origin of this invention may be traced back to the year 1680. About that period, coal came to be substituted for wood as fuel in London and other places. The consequent consumption of Newcastle coal became so considerable, that the difficulty and expense of maintaining a great number of horses employed to convey the coals from the pits to the vessels, and the cost of maintaining the roads, gave rise to the introduction of waggon roads, or wooden rail-ways. On these rail-ways, a horse could draw a waggon of a large size, owing to the

* Tilloch, vol. xxxviii, p. 51

Machine for raising Water to any height.

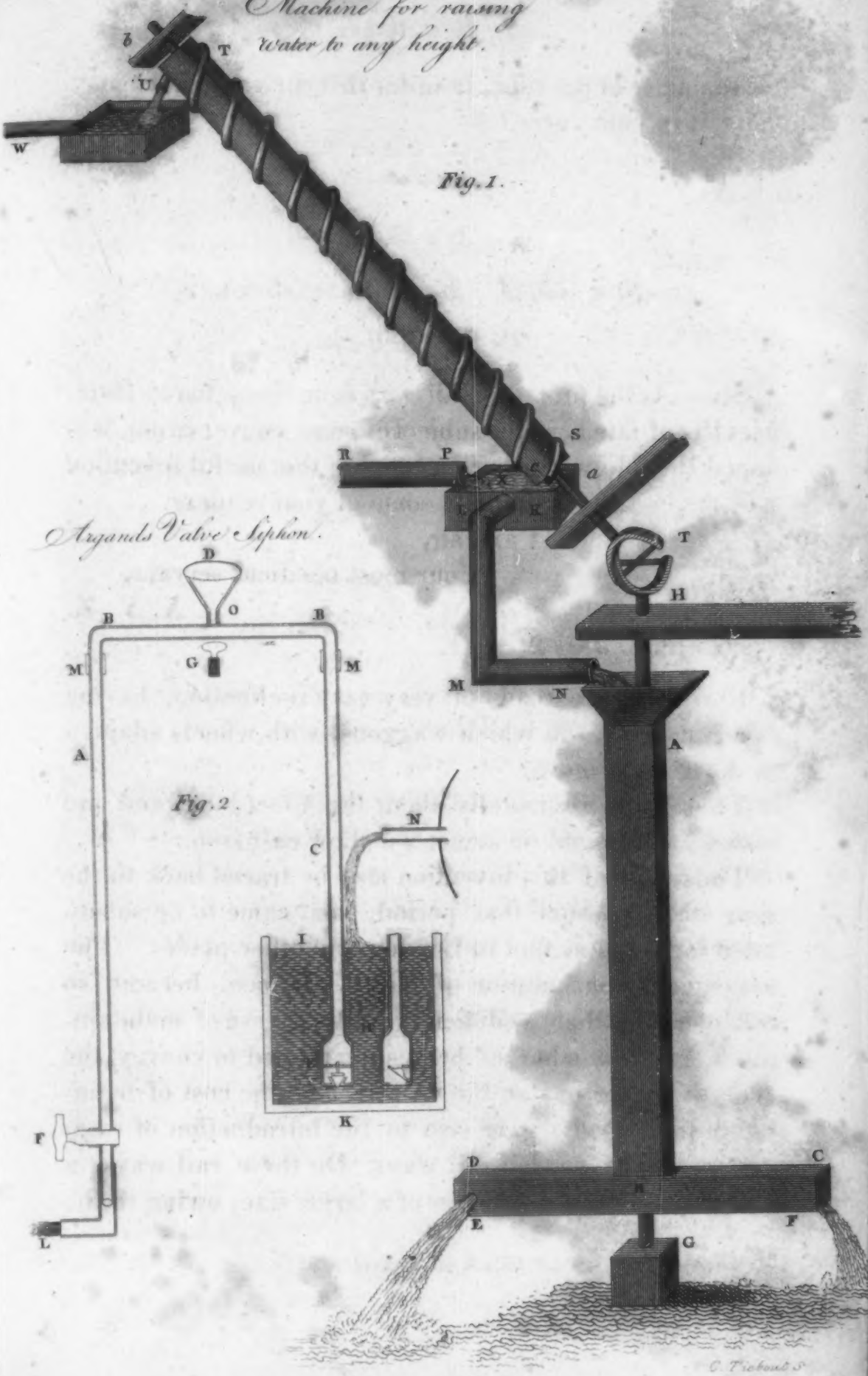

Fig. 1.

Argands Valve Siphon.

Fig. 2.

C. Tiebout S.

Emporium of Arts & Sciences Vol. 2. pl. I.

regular and easy descent with which the rails were laid. It was not until the year 1738 that this improvement was introduced at the Whitehaven colleries. Afterwards, attempts were made in different parts to introduce cast-iron instead of wooden rail-ways, but, owing to the great weight of the waggons then in use, these attempts did not succeed.

About the year 1768, a remedy was contrived for the principal objection to cast iron rail-ways; namely, the making use of several small waggons linked together, instead of one large one; thus diffusing the weight over a greater surface of the road, and consequently throwing less stress on any one part of it. Soon after the year 1797, they began to be constructed as branches to canals: since that period they have rapidly increased, and their great utility is now unquestionably established.

As on canals, *locks* are required in order to raise the vessels from a lower to a higher level, and *vice versa;* so, on rail-ways, what are called *inclined planes* are often necessary to attain the difference of level.

These inclined planes are generally, compared with the rest of the rail-way, very steep. A perpetual chain raises and lowers the waggons. It is so contrived, that the waggons disengage themselves the moment they arrive at the upper or lower extremity of the inclined plane. In some cases, the laden waggons descending serve as a power to bring up the empty ones; but where there is an ascending as well as a descending traffic on the rail-way, steam engines, water wheels, or other machines to answer the same purpose, are used. At Chapel le Frith, there is an inclined plane about 550 yards long, so that the chain extended is, of course, more than double that length.

Most rail-ways of considerable extent require the use of this species of machinery for attaining the difference of level requisite, more particularly in cases where minerals form any considerable part of the traffic. On the proposed rail-way between Glasgow and Berwick, several inclined planes will be required; the summit of that rail-way being 753 feet above the level of the end of Berwick quay.

The waggons are constructed on various plans, and are probably, in most cases, far from the degree of improvement of which they are susceptible. But, with all their disadvantages, the following facts will evince the great saving of animal force to which rail-ways gave rise.

1. With $1\frac{1}{4}$ inch per yard declivity, one horse takes downward three waggons, each containing two tons.

2. In another place, with a rise of $1\frac{6}{10}$ inch per yard, one horse takes two tons upwards.

3. With eight feet rise in 66 yards, nearly $1\frac{1}{4}$ inch per yard, one horse takes two tons upwards.

4. On the Penrhyn rail-way, (same slope as the above,) two horses draw downwards four waggons, each containing one ton of slate.*

5. With a slope of 55 feet per mile, one horse takes 12 to 15 tons downwards, and four tons upwards, and all the empty waggons.†

6. At Ayr, one horse draws on a level five waggons, each containing a ton of coal.

7. On the Surry rail-way, one horse, on a declivity of one inch in ten feet, is said to draw thirty quarters of wheat.‡

* See Plymley's Agricultural Report of Shropshire.

† Repertory of Arts, &c. vol. iii. 2d series.

‡ Malcolm's Agricultural Report of Surry.

Other actual cases might be given, but these will suffice to show the great saving of animal force.

From these cases, and the known laws of mechanics, we may perhaps safely infer, that where the apparatus is tolerably well constructed, and the slope ten feet per mile, one horse may draw five tons upwards, and seven tons downwards. Now, if I am rightly informed, horses at present draw from Sanquhar to Dumfries only about $9\frac{1}{2}$ cwt. of coal at an average each. But say half a ton; then, on the slope stated above, *one horse* would, taking weight upward, do the work of *ten* on the turnpike road, and downward, of *fourteen*. Hence, in this point of view, it may be said that a rail-way would bring the coal mines ten times, at least, nearer to Dumfries than they are at present.

The principal rail-ways in England and Wales, a short time ago, were—the *Cardiff* and *Merthyr*, $26\frac{3}{4}$ miles long; runs very nearly by the side of the Glamorganshire canal.

The *Caermarthenshire*.—In the deep cuttings for this rail-way, several unknown veins of coal were discovered, and some of lead ore.

The *Serhowry*, twenty-eight miles, in the counties of Monmouth and Brecknock.—The *Surry*, twenty-six miles.

The *Swansey* and *Oystermouth*, $7\frac{1}{2}$ miles; and many others, as branches to canals. Since these were executed, many have been added, and they are daily increasing in number.

In Scotland they have been long used about some of the coal works, and are now fast increasing. A public rail-way is now nearly completed between Kilmarnock and the Troon harbour.

No. 7.

New Method of applying the Filtering Stone for purifying Water. By Mr. William Moult.

[With an engraving.)

Sir—If you think the following information, relative to a new method of filtering water, is deserving of the attention of the Society of Arts, &c. I wish you would lay it before them. My objections to the old method of filtering by putting water into the filtering stone are, that the dirt falls to the bottom, and fills up, or chokes the pores of the filtering-stone, so that the stone requires frequently to be cleaned with a brush and sponge to allow the water to pass, after which the water passes through the stone in a muddy state for two or three days; it likewise requires to be frequently filled, and as it empties, less water comes into contact with the stone, and therefore a smaller quantity, in such a state, can only pass through. Likewise a filtering stone used in the common way soon becomes useless, from the filth insinuating itself into the internal parts of the stone, out of the reach of the brush.

In the method I propose and practise, the filtering-stone is placed within the water to be purified, which presses upon the outside of the filter, and the stone does not require to be supported in a frame as it needs only to stand within the water cistern; it will thus filter, in an equal time, double the quantity of water procured in the common mode; it fills itself, and requires no cleaning. I have upon this plan used one for more than three years with great success. I am, &c.

April 18, 1810. William Moult.

* Nicholson, vol. xxix, p. 324. From Trans. of the Soc. of Arts, vol. xxviii, p. 212. The silver medal was voted to Mr. Moult.

Mr. Moult's Filtering Apparatus.

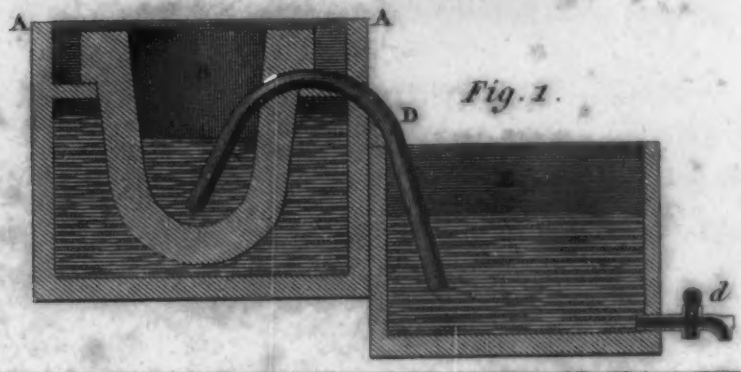

Fig. 1.

Smiths method of relieving a horse which has fallen in the Shafts of a loaded Cart.

Fig. 2.

Taylor's Machine for raising Water.

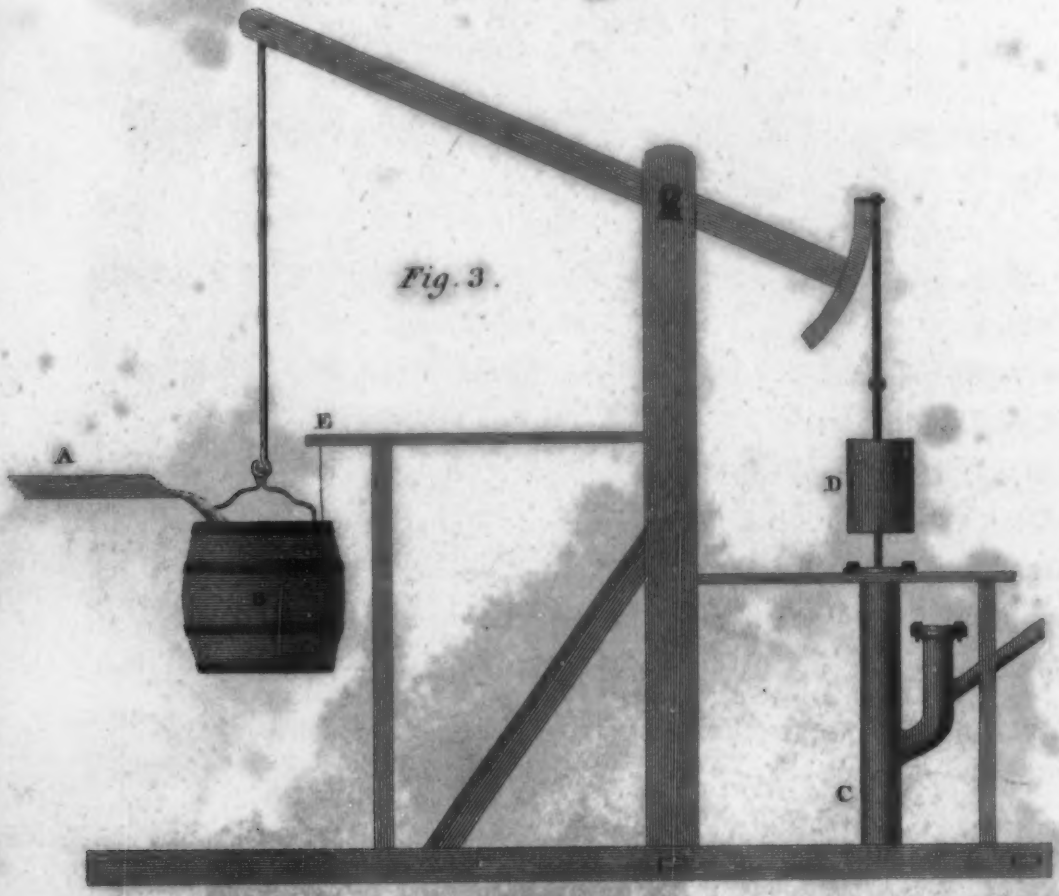

Fig. 3.

Emporium of Arts & Sciences Vol. 2. pl. 2.

E. Tisbaut S.

CERTIFICATES.

We, the undersigned, having inspected and examined a new mode of employing the ordinary filtering-stone, discovered by William Moult, are of opinion that its superiority over the customary method is so great as to entitle it to particular notice.

That it not only supplies an infinitely greater quantity of purified and limpid water, but is capable of preserving its porosity free and pervious for years together, by an occasional self-operation.

That by this valuable process the principal objections to drip-stones is removed, viz. the constant labour they require to keep them clean by means of brushes, without eventually producing the intended effect, and without preventing their being finally rendered useless.

D'Arcy Preston, captain in the Royal Navy;
Charles Gower, M. D.;
Thomas Pitt, Esq. V. P. Wimpole street;
Richard Davenport, Esq. Wimpole street.

Reference to the Drawing of Mr. Moults Filtering Apparatus, Fig. 1, Pl. 2.

AA is the cistern containing the water to be filtered; the filtering stone B is suspended in the cistern by a ring around the inside of it, which catches the projecting part of the stone; the water in the cistern filters through into the stone. D is a siphon, which conveys the filtered water from the inside of the stone into a cistern E, which is the reservoir for clean water. *d* a cock to draw it off as it is wanted. By this mode of filtration the impurities of the water are deposited in the bottom of the cistern A, instead of being left in the bottom of the stone as in the usual mode.

No. 8.

Method of raising a loaded Cart, when the Horse in the Shafts has fallen. By Mr. Benjamin Smith.*

(With an engraving.)

Sir—I have taken the liberty of sending you a model, with a brief explanation of the utility of my invention, in order that it may be laid before the Society instituted for the Encouragement of Arts, &c. to whose comprehensive judgment and abilities I with great deference submit it for their determination, whether they think it likely to be attended with the success and utility which I flatter myself it deserves. From the simplicity of the construction and the trivial expense attending it, I presume there will be no bar to its universal adoption. I respectfully submit it to the discernment and decision of the society, who will, I am convinced, give it all the merit and approbation it may deserve.

The reason which prompted me to undertake this business is from having seen a horse, which had fallen down under the immense weight of a heavy loaded cart, where it lay for a considerable time in that painful and dangerous situation, which naturally excited compassion even in the most obdurate heart. Every person frequenting the streets of this metropolis must have witnessed similar scenes; and indeed it surprises me, that long before now some expedients have not been publicly suggested to remove the mischief arising from such occurrences, considering the great encouragement that is given in this enlightened age to all useful improvements.

Having conversed on this subject with persons who

* Nicholson, vol. xxix, p. 326. From Trans. of Soc. of Arts, vol. xxviii, p. 213. Fifteen guineas were voted to Mr. Smith.

possess considerable knowledge of horses, and who constantly employ these noble animals, I find, that horses remaining so long as they usually do in such improper positions, and from being often dragged a considerable distance by fruitless endeavours to raise them, are much endangered in their health and lives, and that their situation upon the stones is more prejudicial than the injury received by the fall.

I flatter myself that my method will be found to raise the whole weight of the cart, and a considerable part of that of the horse, in the short space of three or four minutes from the moment of the accident, by means simple and useful, and within the reach of the meanest capacity to execute; and that the whole apparatus will not cost above fifty shillings, and will last many years. Requesting your kind attention,

I am, Sir,

Your most obedient servant,

BENJAMIN SMITH.

London, December 13, 1809.

Advantages derivable from this Invention.

1.—The invention is of itself so simple, and the operation so conspicuous at the first view, that the whole process may be easily comprehended and executed.

2.—The apparatus may be fitted with little difficulty to any cart now in use for heavy loads, such as bricks, coals, corn, or the like.

3.—The chains, which lead from the uprights at the back part of the cart to the fore part of it on each side, are for the purpose of taking the purchase therefrom, and making the back part of the cart act as a lever at the time the horses are drawing behind, which, without fail, with the strength of one, two, or three horses fastened

there to raise the one which is down in the shafts, will instantly assist him to get upon his feet.

4.—The number of horses to draw a cart are usually in proportion to the weight contained therein; therefore supposing three horses are employed to draw it, and the shaft horse falls, the carman has only to unhook the two leaders, and then hook them to the short chain at each side of the back of the cart, and with their strength the fallen horse will be so relieved from the weight, as to raise himself without farther assistance.

5.—The same principle may be applied in different ways from what I have shown in the model; for instance, another mode may be adopted by framing the tail board of the cart strong enough to bear the purchase; and, with the use of the two side chains above mentioned, it may be made to answer the purpose.

Another plan, though more expensive, is by obtaining two wrought iron uprights to be fixed as substitutes for the truss staffs at the back part of the cart, with a hole in the top of each to receive an iron rod, which is occasionally to be introduced, reaching from one side of the cart to the other, connecting the two uprights together; when in action the two side chains to be used as in other cases.

Reference to the Drawing of Mr. Smith's Method of raising up a Horse when fallen down in the Shafts of a loaded Cart, Fig. 2, Pl. 2.

A is the wheel, and B the shafts of a cart, such as is used in London; C the side rails; at the end of the body an iron stancheon or truss staff, *a*, is fixed by the hinge at the lower end, and at the upper end it is supported by a chain *b*, extended from the fore part of the body of the cart; this diagonal chain forms a firm support to the stancheon. This is all the addition made to the common

cart, and is used in the event of the shaft horse falling, by hooking the traces of the other horses to a chain *d*, also fixed to the stancheon; the power of these horses, applied at this height above the fulcrum, will have a great purchase to elevate the shafts, and set the fallen horse at liberty, as is evident from an inspection of the figure. The stancheon moves on a joint on its lower end, and the oblique chain unhooks at *b*; the end can be connected with a short piece of chain *e* fastened to the last of the side rails; the stancheon now takes the position of the dotted lines *f*, and the short chain, which hangs down perpendicular from the end of it, may be taken hold of by any number of men, to weigh upon and raise the cart in cases where the horses cannot conveniently be applied; the men will in this manner have much greater effect than merely (as is the common practice) weighing on the hind part of the cart.

When the chain is completely detached, and the stancheon suffered to hang down perpendicularly, it forms a prop to support the cart steady while it is unloaded. It should be observed, that, though only one stancheon appears in the figure, there are in fact two, one being placed on each side of the cart.

Certificate.

Mr. William Whitehead, jun. of Cadogan place, Sloane street, certified, that he had attended experiments made to ascertain the efficacy of Mr. Smith's invention; that a cart weighing twenty-three hundred weight, loaded with one ton of stones, was raised by means of Mr. Smith's apparatus with ease by one horse.

That he very much approves of Mr. Smith's invention, and thinks it likely to be of great service in general practice, more especially on account of the business being ef-

fected with little expense. That many carts are already so formed, that very little additional apparatus will be required to complete them for the purpose.

No. 9.

Description of a very cheap Engine for raising Water. In a Letter from Mr. H. Sarjeant *of Whitehaven, to Mr.* Taylor, *Secretary to the Society for the Encouragement of Arts.**

(With an engraving.)

Sir—I am sensible that the little engine, a drawing of which accompanies this letter, can lay no great claim to novelty in its principle; nevertheless it is respectfully submitted to the consideration of the society, how far its simplicity, and cheapness of construction, may render it worthy of their attention, with a view to its being more generally known and used in similar cases.

Irton Hall, the seat of E. L. Irton, Esq. is situated on an ascent of sixty or sixty-one feet perpendicular height; at the foot of which, at the distance of about one hundred and forty yards from the offices, runs a small stream of water. The object was to raise this to the house for domestic purposes.

To this end a dam was made at a short distance above, so as to cause a fall of about four feet; and the water was brought by a wooden trough, into which was inserted a piece of two-inch leaden pipe, a part of which is seen at A, plate 2, fig. 3.

The stream of this pipe is so directed as to run into the bucket B, when the bucket is elevated; but so soon

* Nicholson, vol. ii, p. 60. From the Transactions of the Society, for 1801, p. 255. The silver medal was given to the Inventor.

as it begins to descend, the stream flows over it, and goes to supply the wooden trough or well in which the foot of the forcing pump C stands, of three inches bore.

D, is an iron cylinder attached to the pump rod, which passes through it. It is filled with lead, and weighs about two hundred and forty pounds. This is the power which works the pump, and forces the water through four hundred and twenty feet of inch pipe from the pump up to the house.

At E is fixed a cord which, when the bucket comes to within four or five inches of its lowest projection, becomes stretched and opens a valve in the bottom of it, through which the water empties itself.

I beg leave to add, that an engine, in a great degree similar to this, was erected some years ago by the late James Spedding, esquire, for a lead mine near Keswick, with the addition of a smaller bucket which emptied itself into the larger, near the beginning of its descent, without which addition it was found that the beam only acquired a libratory motion, without making a full and effective stroke.

To answer this purpose in a more simple way, I constructed the small engine in such manner as to finish its stroke (speaking of the bucket end,) when the beam comes into an horizontal position, or a little below it. By this means the lever is virtually lengthened in its descent in the proportion of the radius to the cosine, of about thirty degrees, or as seven to six nearly, and consequently its power is increased in an equal proportion.

It is evident that the opening of the valve might have been effected, perhaps better, by a projecting pin at the bottom; but I chose to give an exact description of the engine as it stands. It has now been six months in use, and completely answers the purpose intended.

The only artists employed, except the plumber, were a country blacksmith and carpenter; and the whole cost, exclusive of the pump and pipes, did not amount to five pounds. I am, &c.

H. SARJEANT.

Warwick Court, Holborn.

Mr. CHARLES TAYLOR.

In another letter, dated Whitehaven, April 28, 1801, Mr. Sarjeant further observes that the pump requires about eighteen gallons of water in the bucket to raise the counter-weight, and make a fresh stroke in the pump; that it makes three strokes in a minute, and gives about a half gallon into the cistern at each stroke. He adds, "I speak of what it did in the driest part of last summer; when it supplied a large family, together with work people, &c. with water for all purposes, in a situation where none was to be had before, except some bad water from a common pump which had been since removed. But the above supply being more than sufficient, the machine is occasionally stopped to prevent wear, which is done by merely casting off the string of the bucket valve."

NO. 10.

On curing British White Herrings in the Dutch method. By FRANCIS FORTUNE, *Esq.**

BEING desirous that the greatest degree of publicity should be given to every particular relative to the manner in which the Dutch were used to cure their herrings; and being aware of the extensive circulation of the Trans-

* Repertory, No. 122, second series, p. 124. From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

actions of the Society for the Encouragement of Arts, &c. I feel anxious that a communication likely to be referred to by so many for information, should be intelligible and satisfactory. Under these impressions, and observing that the Society desire "that papers sent to them should be full, clear, and explicit," rather in the form of essays than of letters, I have stated more than perhaps may appear at first sight absolutely necessary, but I flatter myself not more than may prove really useful.

In the deep sea (which is the principal fishery for herrings) the nets are cast from the busses by sunset, and they drive by them alone expecting the shoals, the approach of which is generally indicated by small quantities of fish; and their arrival by immense flights of sea fowl. The best fishing is with the wind off shore, for, when it blows in a contrary direction, the shoals are broken and dispersed, and the fishery is seldom successful while it continues in that point.

Immediately after the nets are hauled in, (which is often performed with considerable difficulty, by means of a windlass, when they are full,) the crew begin to gyp the fish, that is, to cut out the gill, which is followed by the float or swin, and divide the large jugular or spiral vein with a knife at the same time, endeavouring to waste as little of the blood as possible;—at this work the men are so expert, that some will gyp fifty in a minute.

Immediately after they are gypped, they are put into barrels, commencing with a layer of salt at the bottom, then a tier of fish, each side by side, back downwards, the tail of one touching the head of the other, next a layer of salt, and so alternately until the barrel is filled; they are thus left, and the blood which issues from the fish, by dissolving the salt forms a pickle infinitely

superior to any other that can be made. The herrings thus drained of their blood occupy less space, and the whole consequently sinks about one-third down the barrel, but this sinking is at end in about three or four days.

When these operations are being performed, the sea is often running mountains high; and it is not therefore to be supposed, that the barrels are so well coopered as not sometimes to allow the pickle to leak out; and in order to preserve the fish from being spoiled, which would otherwise happen in such cases, some of the gills and entrails are always put by in barrels with salt, in the same manner as the herrings, and yield a pickle of the same quality; with this pickle those barrels which have leaked are replenished, and the fish sustains no injury. Every operation is performed in the shade, into which the fish are immediately conveyed, on their being hauled on board. Each day's fishing is kept separate with the greatest care. The salt used is mixed, and of three different sorts, *viz.* English, St. Ubes, and Alicant, and each barrel marked with the date of the month on it on which it was filled.

The advantages of gypping the herrings are, that the blood which issues in consequence of the operation from the fish, yields a natural pickle, and improves the flavour; whereas, if left in the fish, it becomes coagulated at the back bone, and forms the first cause of decay. The mixture of blood and salt operated upon by the extreme heat of the weather during the summer fisheries, produces a fermentation which nearly parboils the herrings, and removes the coarse and raw flavour so often complained of. The gypping is likewise often performed on shore, observing the same precautions; the only difference is, that they are seldom in that case of so good a colour. Gypped herrings are never of so fine a quality as

when kept in their own original pickle; their value consists in their softness and flavour; it is this mode of curing herrings that used to be the pride of the Dutch, and this is the kind which supplied their home consumption, and were so much esteemed by all classes of people in Holland.

In order, as far as is possible, to give a proof of the correctness of the above assertion, I shall state a fact for the information of the Society. During the last year, I employed a number of Dutch fishermen, prisoners, and others, with Englishmen, in gypping and curing herrings; and at one time, my agent at Yarmouth was offered four pounds per barrel for all the herrings he had cured there, by a Dutch captain, in order to their being taken to Holland, while ungypped herrings were worth only thirty-six shillings per barrel. The herrings now under consideration of your Society, are part of the quantity for which that offer was made.

NO. 11.

Report made to the Institute on a Memoir, by **M. Tarry**, *on the Composition of Writing Ink. By Messrs.* **Berthollet, Vauquelin,** *and* **Deyeux.***

The object proposed by M. Tarry in his memoir is to explain:

1. The processes employed for discharging writing from paper.

2. The processes for reviving writings which have been apparently obliterated.

3. The best way to improve common ink.

* Tilloch, vol. xxxviii, p. 34. From Annales de Chimie, tome lxxv, p. 194.

4. Finally, the discovery of an ink which should resist all chemical agents.

We shall now give an abridgement of these four articles:

ARTICLE I.

Processes for Discharging Writing.

The art of discharging writing is very ancient, and the means employed are very simple. In fact, we know that it is sufficient to moisten a written paper with any acid, when the writing will gradually disappear. But all the acids cannot be employed with equal success. Some leave a stain on the paper which is not easily removed: others corrode and render the paper unserviceable. The way to avoid these inconveniences is to make choice of an acid which shall act on the writing only, without injuring the paper or giving it a colour different from that which it had before it was written upon.

In order to discover such of the acids as are best suited for the operation in question, the author determined to submit common writing ink to the action of different acids, and to observe carefully the phenomena which these bodies present at the time of their mixture. According to him, the sulphuric acid easily takes out writing, but at the same time it gives an oily tint to the paper.

The acid oxalate of potash produces more certain and more prompt effects. The oxygenized muriatic acid, if it be newly made, seems to be preferable to the above two acids, because at the same time that it takes out the writing it bleaches the paper without altering it.

It is not the same case with the nitric acid, which always takes out the ink, but soon penetrates the pa-

per and forms above it undulated lines of a yellow colour.

We may succeed, however, in softening both these effects, by taking the precaution to dilute the nitric acid with a sufficient quantity of water, or to wash the paper immediately after the writing has been taken out.

A mixture of the muriatic and nitric acids has but a slow action upon writing. It bleaches the paper and does not oppose its desiccation, as when we employ the nitric acid alone.

In general, whatever be the kind of acid employed to discharge writing, it is always proper when the operation is performed to dip the paper in water, in order to dissolve the new combinations which the acids have formed with the particles of ink which have been discharged.

M. Tarry, at the conclusion of this article, does not fail to observe that China ink does not act like common ink with the acids, as its composition is quite different from that which we use for writing of all kinds. So far from the acids attacking China ink, they make it, on the contrary, of a deep black: it cannot be discharged therefore without erasing it.

ARTICLE II.

Processes for ascertaining what Writing has been substituted for something taken out, and Methods of reviving the Writing which has disappeared.

All the methods which have been given for discharging writing consist, as abovementioned, in decomposing the ink and in forcing its constituent parts to form other combinations. These combinations, being decomposed in their turn by different agents, may regain a tint, which,

if it be not that of ink, at least exhibits a shade which becomes perceptible enough for ascertaining the letters and words which had been traced on the paper before it was touched by the acids.

The gallic acid is, according to the author, one of those agents, which in this case succeeds very well.

The liquid prussiate of lime also produces a good effect.

It is the same case with the alkaline hydrogenated sulphurets. But it is very certain that we never obtain any success from the employment of these agents, when we have left any acid long in contact with the writing, and particularly if we have washed the paper afterwards.

In short, we may easily conceive, that in this case the constituent parts of the ink which were combined with the acid, and had formed with it compounds soluble in water, having been taken up by this fluid, ought not to leave any trace of their existence longer; and consequently it is impossible that the agents employed for discovering them can render them visible.

It is also for this reason that the gallic acid, the liquid prussiate of lime, the alkaline hydrogenated sulphurets, and so many other reagents which have been so much praised, can no longer be regarded as infallible methods for reviving writing.

ARTICLE III.

Improvement of Common Ink.

Most of the inks now in use are of a bad quality. Some are spontaneously destroyed; others imperceptibly lose their black colour, and assume a yellow one; several, after a length of time, enter into the paper, and spoil it:

lastly, there are some which are first pale and then become very black.

All these differences arise from the nature of the substances which have been employed in the making of the ink.

Convinced of the advantage of having a good article of this kind, the author commenced a series of experiments, but is forced to admit that he has not discovered any receipt superior to that which has been published by Lewis. This ink, according to our author, combines every advantage: but we must observe that it is no more exempt than the rest from being dissolved in the acids, and in this respect it has an inconvenience which those who wish to discharge writing from paper know very well how to profit by. This circumstance, no doubt, induced M. Tarry to make some new experiments in order to obtain an ink which should be inalterable by chemical agents; and he appears to us to have succeeded in his object.

ARTICLE IV.

Discovery of an Ink which resists the Action of Chemical Agents.

The author describes his invention in the following words:

"My ink is founded upon principles different from those of all others. It contains neither gall nuts, Brazil wood, or Campeachy, gum, nor any preparation of iron: it is purely vegetable, resists the action of the most powerful vegetables, the most highly concentrated alkaline solutions, and, finally, all the solvents.

"The nitric acid acts very feebly upon the writing performed with this ink. The oxymuriatic acid makes it assume the colour of pigeon's dung. After the action of

this last acid, the caustic alkaline solutions reduce it to the colour of carburet of iron: the characters of the writing nevertheless remain without alteration, and it cannot pass through these different states except after long macerations. The principles of which it is composed render it incorruptible, and it can retain its properties many years."

The results which we obtained, coincided entirely with those of the author, and we have no hesitation in saying, that his is the best we have ever seen of the kind which is called indelible ink. It is liable, however, to deposit a sediment, a disadvantage which we think might be removed by M. Tarry after a few more experiments. We have tried to discharge it with all the known chemical agents, but without effect; and we think the inventor deserves the thanks of the Institute, and of the community at large.*

* It may, perhaps, be acceptable to our readers to have Dr. Lewis's receipt given in this place. His observations are to be found at large in the Commerce of Arts.

"Put into a stone or glass bottle, or any other vessel, three ounces of finely powdered galls, one ounce of green vitriol, one ounce of logwood, finely rasped or bruised, one ounce of gum arabic, and a quart of soft water. Shake the bottle well, and let the ingredients stand in a moderately warm place for a week or ten days, shaking it frequently in the day. It is then fit for use; but a little before it is put into the ink-stand, it is better to shake the bottle that the colour may be more uniformly diffused."

I have tried this and various other receipts for ink; but after an experience of several years, I prefer the following, by Mr. Ribancourt, from Chem. Annal vol. ii.

"Eight ounces of galls, and four ounces of logwood, are boiled with twelve pounds of water for an hour, or till one half of its quantity is evaporated. This liquor is then percolated through a hair sieve, and four ounces of vitriol, or sulphate of iron, three ounces of gum arabic, one ounce of copperas or sulphate of copper, (so in the copy,) and one ounce of sugar candy, are added. The whole mass is stirred to promote the solution of the salts and gum, after which it is left to stand for twenty-four hours. The liquid is then poured off from its coarse sediment, and preserved in well stopped glass or stone jars. This ink acquires a beautiful black colour, which it retains for a long time."

It is to be regretted that Mr. Tarry has not given us the receipt for his ink, which such celebrated chemists as the authors of the above report, speak so highly of. EDITOR.

No. 12.

Extract from a Memoir on Vegetable and Animal Analysis. By M. M. Gay Lussac *and* Thenard.*

When we had conceived the project of analysing animal and vegetable matters, the first consideration which presented itself to our serious attention was to transform, by means of oxygen, the vegetable and animal substances into water, carbonic acid, and azote. It was evident that if we could succeed in operating the transformation so as to collect all the gases, this analysis would be accomplished with very great precision and simplicity. Two obstacles presented themselves: one was to burn completely the hydrogen and the carbon of these substances, and the other to operate the combustion in close vessels.

We could expect to surmount the first difficulty only by means of the metallic oxydes which easily give up their oxygen, or by the hyper-oxygenated muriate of potash. Some experiments soon made us give the preference to the above salt, which succeeded beyond all expectation. It was not quite so easy, however, to overcome the latter difficulty; for we could not attempt combustion in a retort full of mercury. To prevent the matter from being burnt, the retort must have been broken: it became necessary to find an apparatus, therefore, in which we might—

1. Burn portions of substance so small as not to fracture the vessels.

2. To make a great number of successive combustions, in order that the results might be perceptible.

3. To collect the gases as they were formed.

* Tilloch, vol. 38, p. 60. From Annales de Chimie, tome 74, p. 47.

We now exhibit to the class* an apparatus of the above description. It is formed of three distinct pieces: one is a very thick glass tube, closed at its lower extremity by the blow-pipe, and open at its upper end, about two decimetres in length, and eight millimetres in breadth; it has laterally, five centimetres from its aperture, a very small tube also of glass, which is soldered to it, and which resembles that which we should adapt to a retort for receiving the gases. The other piece is a copper ferule into which we insert the open extremity of the large glass tube, and with which it is united by means of a mastic which melts only at forty degrees. The last piece is a peculiar kind of stopcock, in which the whole merit of the apparatus consists. The key of this stopcock has no hole through it, and turns in every direction without giving vent to the air: there is simply about the middle of it a cavity capable of receiving a small pea: but this cavity is such that being in its upper position, it corresponds to a small vertical funnel which penetrates the socket, and of which it forms in some measure the extremity of the beak, and which when brought back to its lower position communicates with, and is a continuation of, the body of the stopcock, which is hollow, and is screwed to the ferule. Thus, when we put small fragments of any matter into the funnel and turn the key, the cavity is soon filled, and carries the matter into the body of the stopcock, from which it falls into the ferule, and from thence to the bottom of the glass tube.

If this substance, therefore, be a mixture of hyper-oxygenated muriate of potash and of vegetable substance in proper proportions, and if the lower part of the glass tube be sufficiently warm, it will briskly take fire: the vegetable substance will then be instantaneously destroyed and transformed into water and carbonic acid, which will be

* Of the National Institute. EDITOR.

collected over mercury with the oxygen gas issuing by the small lateral tube.

In order to execute this operation easily, we may conceive that it is necessary that the matter be detached entirely from the cavity and fall to the bottom of the tube. For this purpose it is made up into small balls, as will be mentioned presently: we may also conceive that it is necessary to inquire what is the proper quantity of hyper-oxygenated muriate for burning completely vegetable substance. We must even take the precaution to employ at least one half more than this substance requires, in order that the combustion may be complete.

But of all the inquiries which ought to precede the operation, the most important is the analysis of the hyper-oxygenated muriate employed; for upon this all the calculations of the experiments are in a great measure founded.

All this being well understood, it will be easy to analyse a vegetable substance with the hyper-oxygenated muriate. The substance is to be ground on a porphyry slab with the greatest care, as also the hyper oxygenated muriate; quantities of both are to be weighed in very accurate scales; they are to be well mixed, moistened, and rolled into cylinders; these are to be divided into small balls, which are to be exposed to a boiling heat in order to render them as dry as the original materials were. If the substance to be analysed is a vegetable acid, it is to be combined with lime or barytes before mixing it with the hyper-oxygenated muriate: the salt which results is to be analysed, and an account is to be taken of the carbonic acid which remains united to the base after the experiment: lastly, if the substance to be analysed contains some bodies which are foreign to its nature, they are also to be taken account of.

Thus we know accurately that a given weight of this mixture represents a known weight of hyper-oxygenated muriate, and of the substance which we wish to analyse.

Now in order to finish the operation, nothing more is requisite than to make the bottom of the tube red hot: to drive off all the air by means of a certain number of balls, which we do not weigh, and which we throw in one after another; then to decompose in the same manner a weight of them precisely determined, and carefully to collect all the gases in flasks full of mercury and gauged beforehand.

If all the flasks are of the same capacity, they will be filled with gas by equal weights of mixture; and if we examine these gases, we shall find them perfectly identical, an evident proof of the extreme accuracy of this method of analysis.

The tube ought to be kept during the whole operation at the highest degree of heat which it can support without melting, in order that the gases may not contain any oxy-carburetted hydrogen gas. In all cases the analysis ought to be performed over mercury. This is a proof to which it is indispensable to subject them: for this purpose it is sufficient to mix them with one fourth of their volume of hydrogen, and to pass an electric spark into them. As they contain a great excess of oxygen, the hydrogen which we add, and of which an account must be kept, burns as well as the whole oxy-carburetted hydrogen which they may contain; and we thus acquire the certainty that they are no longer formed of any thing but carbonic acid and oxygen, which must be separated by potash.

But this necessity of raising the temperature obliges us on the other hand to take some precautions in order that the stopcock may not be heated. With this view the glass

tube is passed through a brick to which it is fastened with clay, and which at the same time gives solidity to the apparatus: besides this, we must solder to the body of the stopcock a small hollow cylinder in which water is put, or rather ice.

We have thus all the necessary data for knowing the proportion of the principles of the vegetable substance: we know how much of this substance has been burnt, since we have the weight of it to a demi-milligramme: we know how much oxygen is wanted to transform it into water and into carbonic acid, since the quantity of it is given by the difference which exists between that contained in the hyper-oxygenated muriate and that contained in the gases: lastly, we know how much carbonic acid is formed, and we calculate how much water ought to be formed.

By following the same order of analysis, we also succeed in determining the proportion of the constituent principles of all the animal substances. But as these substances contain azote, and as there would be a formation of nitrous acid gas, if we employed an excess of hyper-oxygenated muriate in order to burn them, we need only employ a quantity sufficient for reducing them completely into carbonic acid gas, oxy-carburetted hydrogen, and azote, of which we perform the analysis in the eudiometer with mercury by the common methods, and from which we may conclude exactly that of the animal substance itself.

The method in which we proceed to the analysis of vegetable and animal substances being exactly known, we can tell what quantity of it we decompose without any fear of weakening the confidence which we ought to have in our results. This quantity rises at most to six decigrammes: besides, if there was the smallest doubt as to their exactness, we could get rid of it upon recollecting

that we fill successively with gas, two and sometimes three flasks of the same capacity; that these gases are identical, and always proceed from one and the same weight of materials.

We might add, that the exactness of any analysis consists rather in the accuracy of the instruments, and of the methods which we employ, than in the quantity of matter upon which we operate. The analysis of the air is more exact than any analysis of the salts, and yet it is performed upon two or three hundred times less matter than the latter. This is because in the former, where we judge of weights by volumes which are very considerable, the errors which we may commit are perhaps one thousand or twelve hundred times less perceptible than in the latter, where we are deprived of this resource. Now as we transform into gas the substances which we analyse, we bring our analyses not only to the certainty of the common mineral analyses, but to that of the most precise mineral analyses: more particularly as we collect at least a litre of gas, and as we find even in our way of proceeding the proof of an extreme exactitude and of the most trifling errors.

We have already methodically analysed, with all the precautions just mentioned, sixteen vegetable substances; viz. the oxalic, tartarous, mucous, citric, and acetic acids; turpentine in resin; copal, wax, olive oil; sugar, gum, starch, sugar of milk, oak and ash wood, and the crystallizable principle of manna. The results which we obtained seem to us to be of the first rate importance, for they led to three very remarkable laws to which the composition of vegetables is subjected, and which may be thus expressed:

First Law.

A vegetable substance is always acid when the oxy-

gen is to the hydrogen in a greater proportion than in water.

Second Law.

A vegetable substance is always resinous, oily, or alcoholic, &c. when the oxygen is in a less proportion to the hydrogen than in water.

Third Law.

Lastly, a vegetable substance is neither acid nor resinous, and is analogous to sugar, gum, starch, sugar of milk, to the ligneous fibre, to the crystallizable principle of manna when the oxygen is in the same proportion as in water.

Thus, supposing for a moment that hydrogen and oxygen were in the state of water in vegetable substances, which we are far from thinking is the case, the vegetable acids would be formed of carbon, water and oxygen in various proportions.

The resins, the fixed and volatile oils, alcohol and ether, would be formed of carbon, water and hydrogen, also in various proportions.

Lastly, sugar, gum, starch, sugar of milk, the ligneous fibre, the crystallizable principle of manna, would only be formed of carbon and water, and would only differ in the greater or less quantities which they contained.

This may be shown by citing various analyses of acid and resinous substances, and of substances which are neither acid nor resinous.

One hundred parts of oxalic acid contain:

Carbon	26.566	Or, rather	Carbon	26.566
Oxygen	70.689		Oxygen and hydrogen in the proportions in which they exist in water.	22.872
Hydrogen	2.745		Oxygen in excess .	50.562
	100			100

One hundred parts of acetic acid contain:

		Or, rather		
Carbon	50.224		Carbon	50.224
Oxygen	44.147		Oxygen and hydrogen in the proportions in which they exist in water	46.911
Hydrogen	5.629		Oxygen in excess	2.865
	100			100

The oxalic acid contains, therefore, more than half its weight of oxygen in excess, in proportion to the hydrogen, whereas in the acetic acid this excess is not quite three centiemes.

These two acids occupy the extremes of the series of the vegetable acids: of all the acids the one is the most, and the other is on the contrary the least oxygenated: this is the reason why it requires so much nitric acid to convert sugar and gum, &c. into oxalic acid; and this is the reason, on the contrary, that so many vegetable and animal substances produce so easily acetic acid in a great many circumstances, and that wine in particular is changed into vinegar without any intermediate acid being formed; a phenomenon which had not been hitherto explained, because vinegar has been regarded as the most highly oxygenated of all the acids.

One hundred parts of common resin contain:

Carbon	75.944
Hydrogen and oxygen in the proportions in which they exist in water	15.156
Hydrogen in excess	8.900
	100

One hundred parts of olive oil contain:

Carbon	77.213
Hydrogen and oxygen in the proportions in which they exist in water	10.712
Hydrogen in excess	12.075
	100

One hundred parts of crystallized sugar contain:

		Or, rather		
Carbon	40.704		Carbon	40.194
Oxygen	52.101		Hydrogen and oxygen in the proportions in which they are in water	59.806
Hydrogen	7.105		Oxygen in excess	0.
	100		Hydrogen in excess	0.
				100

One hundred parts of ash wood contain:

		Or, rather		
Carbon	51.192		Carbon	51.192
Oxygen	42.951		Hydrogen and oxygen in the proportions in which they are in water	48.808
Hydrogen	5.857		Oxygen in excess	0.
	100		Hydrogen in excess	0.
				100

These results prove a very important fact: viz. that water *per se* or its principles are seized upon by the vegetable in the act of vegetation; for, all the vegetables being almost entirely formed of ligneous fibres and mucilage, which contain oxygen and hydrogen in the same proportions as water, it is evident that when carried into the substance of the vegetable it is then combined with carbon in order to form them.

If, therefore, it were in our power to unite these two bodies in every given proportion, and to bring their molecules together in a proper manner, we should certainly make all the vegetables which hold the middle rank between the acids and the resins, such as sugar, starch, the ligneous fibres, &c.

Among the animal substances we have only as yet analysed fibrine, albumen, gelatine, and the caseous substance.

It results from our analyses, that in these four substances, and probably in all analogous animal substances,

the hydrogen is in a greater proportion to the oxygen than in water; that the greater the excess of hydrogen, the greater is the quantity of azote which they contain also; that these two quantities are almost both in the same proportion as in ammonia, and that it is probable that this proportion, which we nearly approach, does actually exist: the more, probably, because we always find a little too much hydrogen, and as all the errors which we can make tend to increase the quantity of it. We shall judge of this by the two following analyses.

One hundred parts of fibrine contain:

Carbon	51.675
Hydrogen and oxygen in the proportion in which they exist in water	26.607
Hydrogen in excess	5.387
Azote	16.331
	100

One hundred parts of caseous matter contain:

Carbon	57.190
Hydrogen and oxygen in the proportion in which they exist in water	18.778
Hydrogen in excess	5.680
Azote	18.352
	100

Admitting this report to be correct, these substances would correspond, with respect to the rank which they ought to hold among the animal substances, to the rank occupied by sugar, gum, ligneous fibre, &c. among the vegetable substances: for in the same way as hydrogen and oxygen, the gaseous principles of the former, may be reciprocally saturated and form water; in the same way hydrogen, oxygen and azote, the gaseous principles of the latter, may be also reciprocally saturated and form

water and ammonia: so that the carbon, which is the only fixed principle which all of them contain, does not possess any property relative to that saturation. If we are guided by analogy, we might compare under this point of view the animal acids with the vegetable acids, and the animal fats (if there are any which contain azote) with the resins and vegetable oils: consequently the hydrogen could not be in a sufficient quantity in the uric acid, for satuating the oxygen and azote which this acid contains, or to form water and ammonia by combining with these two bodies, and the contrary would take place in the animal fats. A numerous train of consequences may certainly be drawn from all the preceding results; but we shall defer the further consideration of the subject till a future occasion.

No. 13.

On preserving Fresh Water sweet during long Voyages.

By Samuel Bentham, *Esquire.**

The Society for the Encouragement of Arts, &c. having thought proper to offer a premium in order to ascertain, for the use of the public, the best mode of preserving fresh water sweet at sea, I request you to lay before the Society an account of the method which I have employed for this purpose on board two ships, and which has been attended with all the success that can be reasonably expected.

The mode in which I conceived fresh water might be preserved sweet, was merely by keeping it in vessels of

* Tilloch, vol. 12, p. 12. From the Transactions of the Society of Arts, &c. Adelphi. London, for 1801.—The Society awarded their gold medal to Mr. Bentham for this communication.

which the interior lining at least should be of such a substance as should not be acted upon by the water, so as to become a cause of contamination. Accordingly, on board the two ships here alluded to, the greater part of the water was kept, not in casks, but in cases or tanks, which, though they were made of wood, on account of strength, were lined with metallic plates, of the kind manufactured by Mr. Charles Wyatt, of Bridge street, under the denomination of tinned copper sheets; and the junctures of the plates or sheets were soldered together, so that the tightness of the cases depended entirely on the lining, the water having no where access to the wood. The shape of these cases was adapted to that of the hold of the ship, some of them being made to fit close under the platform, by which means the quantity of water stowed was considerably greater than could have been stowed, in the same space, by means of casks; and thereby the stowage room on board ship was very much increased.

The quantity of water kept in this manner on board each ship was about forty tuns, divided into sixteen tanks; and there was likewise on board each of the ships about thirty tons stowed in casks as usual.

As the stowing the water in tanks was considered as an experiment, the water in the casks was used in preference; that in the tanks being reserved for occasions of necessity, excepting that a small quantity of it was used occasionally for the purpose of ascertaining its purity, or when the water in the casks was deemed, when compared with that in the tanks, too bad for use.

The water in thirteen of the tanks on board one ship, and in all the tanks on board of the other, was always as sweet as when first taken from the source; but in the other three of the tanks on board one ship, the water was found to be more or less tainted as in the casks. This difference, however, is easily accounted for, by supposing

that the water of these tanks was contaminated before it was put into them; for in fact the whole of the water was brought on board in casks for the purpose of filling the tanks, and no particular care was taken to taste the water at the time of taking it on board.

After the water, kept in this manner, had remained on board a length of time which was deemed sufficient for experiment, it was used out, and the tanks were replenished as occasion required: but in some of the tanks, on board one ship at least, the original water had remained three years and a half, as appears by the certificates herewith inclosed. About twenty-five gallons of the water, which had remained this length of time in the ship, are sent to the Society, in two vessels made of the same sort of tinned copper with which the tanks were lined. I am, &c.

SAMUEL BENTHAM.

MR. TAYLOR.

A certificate from captain William Bolton, commander of the said vessel, dated Sheerness, 28th of June 1800, accompanied this letter, stating, that the water delivered to the Society was taken from a tank holding about seven hundred gallons, and which his predecessor, captain Portlock, had informed him had been poured into this tank in December 1796, except about thirty gallons added in 1798, and had remained good during the whole time.

The signatures to the above accounts were certified on the 28th of June 1800, by the reverend C. Thee, minister of Sheerness.

In a letter dated January 27, general Bentham also states, that the water which had been preserved sweet on board his majesty's sloops Arrow and Dart, and of which he had sent specimens to the Society, was taken from the

well at the king's brewhouse at Weevil, from whence ships of war lying at or near Portsmouth are usually supplied with water for their sea store, as well as for present use.

No. 14.

Recipe for an elastic and permanent Varnish for Hats or Helmets of Felt, Gaiters, or other Parts of Dress in Leather, as Boots and Shoes, and which may be also employed with Success in varnishing Cloth and Linen.*

First Operation.—It is necessary, in the first place, to free the hats, or other articles of felt, from all the gum which they may contain. This may be easily effected by washing them in warm water, and afterwards pressing them. Before they are perfectly dry, they must be placed on moulds in order that they may be preserved in their proper shape, and be without wrinkles,—a very essential requisite. New leather, as well as old, must be scraped in order to clear its superficies from the wax or grease with which it is impregnated. Colophony, or resin in powder, laid upon a coarse brush, also removes the grease perfectly well.

Second Operation.—All felt hats have a kind of down or nap, of which they must be cleared, when dry, by means of pumice stone; and every part of the hat where the varnish is to be applied must be smoothed in this manner. Leather must be smoothed in the same manner also to remove all inequalities, and even the marks of the scraper.

The same method must be pursued with cloths or linens.

* Tilloch, vol. 26, p. 1. From Bibliothèque Physico-Economique, May 1806.

Third Operation.—The down being removed in the manner above described, a coat of the black varnish, to be afterwards mentioned, must be laid on the articles to be varnished. They must be allowed to dry well upon their moulds, that they may not assume any wrinkles, which prevent the proper distribution of the varnish.

Fourth Operation.—This first coat of varnish being perfectly dry, the pumice stone must be again resorted to, in order to remove any small inequalities which may remain.

Fifth Operation.—When the air is dry and warm, a second coat of the black varnish must be applied, and also polished with the pumice stone.

Sixth Operation.—The finishing hand must now be put to the article by laying on the varnish to be afterwards described, taking care to employ for this purpose a small and compact pencil, in order to spread the varnish uniformly and equally.

When the first coat of varnish is well dried, it must be sprinkled with pumice stone reduced to fine powder, and then rubbed all over with a wet sponge, or a piece of fine linen rag also wetted, in order to render the varnish perfectly smooth; or in place of pumice stone, with tripoli soaked in oil and rubbed with the palm of the hand. As to the second and last coat of varnish, it must be polished when well dried, by sprinkling it with starch and rubbing it with a piece of old linen rag, which will give it a very fine lustre.

In the event of the varnish being tarnished, or losing its lustre by long usage, in order to restore it, place the articles of felt or leather in boiling water for a minute, then let them dry thoroughly, sprinkle them with starch, and rub them with a piece of dry linen, and they will resume their former lustre.

Preparation of Linseed Oil, under the Denomination of Oil of Marmite.

Take Linseed oil	.	15 pounds.
Umber	.	4 ounces.
Red lead	.	1 pound 8 ounces.
White lead	.	2 pounds 4 ounces.

Put the whole in a pot placed upon a coal fire; boil it for thirty-six or forty minutes; stir it from time to time with a wooden spatula; and care must be taken that it is neither too little boiled, nor viscous from being too much.

Upon taking the pot off the fire, throw in a piece of bread, both crust and crumb, of the size of a small loaf. Cover it, and let it cool for twenty-four hours. The oil thus prepared is made use of for various purposes.

Composition of the Black Varnish.

1. Take of black umber two pounds thirteen ounces; cut it into small pieces, and place them in a frying pan upon a very brisk fire, and roast it like coffee for about three quarters of an hour; bruise it afterwards upon a marble slab, by mixing it in the manner of painters, with a little boiled linseed oil, and keep it in a stone pot.

2. Take three pounds of verdigrise; reduce it to an impalpable powder; mix it with the boiled linseed oil; then put it into the stone pot which contains the umber.

3. Take of lamp-black one pound, mix it also with boiled linseed oil, and after putting it also into the stone pot, blend the whole well together.

This is the mixture made use of to varnish articles of felt, cloth, or leather, observing that when leather is to be varnished it is essential to give it previously two or three, and sometimes even six coats of linseed oil; it must be well dried each time, in order to extract the grease

from the leather, wax, or fish oil, in order that the varnish may incorporate with the leather more easily. This precaution must be made use of with soft boots, when placed upon moulds or boot-trees; and, without even taking them off, as many coats of varnish may be laid on as necessary.

Method of preparing the Varnish.

Take of Prussian blue	.	12 ounces.
Indigo	. .	12

Bruise these two separately upon a marble slab; mix them up with a little oil, and put them in a pot by themselves.

Afterwards take of gum copal	.	8 ounces.
Prepared nut oil		5
Spirit of turpentine		14

Put the gum-copal, bruised in a matrass with a large neck, upon a strong fire, but not flaming, taking care to stir it often, and to keep it uncovered. We know that the gum is totally dissolved when the smoke has entirely abated in the matrass; pour into it, by little and little, prepared nut oil, stirring it in order to incorporate the whole completely. Afterwards, and in the same manner, the spirit of turpentine is poured in, and the mixture is then taken from the fire, filtered, and cooled; it is then made use of to grind with the Prussian blue and indigo in small quantities at a time, and the whole is well mixed together.

This mixture forms the fine varnish for the purposes indicated.

No. 15.

Account of a Method of making Soap of Wool, with Observations respecting its use in various arts. By M. Chaptal.*

I HAVE already shown the manner of making, at all times, in every place, and at a small expense, a saponaceous liquor which may be conveniently used, instead of soap, for domestic purposes. (See the Report of Messrs. Pelletier, d'Arcet, and Le Lievre, on the art of making soap.†) I shall now present to the public a supplement

* *Repertory*, vol. 7, p. 346. *From the Annales de Chimie.*

† As that part of the report referred to by M. Chaptal appears to be of general utility, we shall here give a translation of it.

A very good way of using soap is, to employ it in a liquid state; that is, dissolved in water. In consequence of which, M. Chaptal proposes that saponaceous liquors should be prepared, which may be used instead of solutions of soap; and, in order to be able to procure such liquors, at all times, in all places, and at a small expense, he advises one or the other of the following methods to be practised. We shall describe them exactly as M. Chaptal communicated them to us, with observations thereon, made by himself.

First Method.

Take the ashes produced from the combustion of wood which has not been floated, and make a ley of them, according to the usual manner; mixing with the ashes a handful or two of quick-lime, well pounded, or recently slaked. Let the ley stand till it is grown clear, by the settling or swimming of the foreign substances contained therein: then pour it into another vessel, and keep it for use. When it is proposed to make use of this ley, take any quantity of oil, and pour upon it thirty or forty times as much of the ley. Immediately a liquor as white as milk will be formed, which, by being well shaken, or stirred, lathers and froths like a good solution of soap. This liquor is to be poured into a washing-tub, or other vessel, and to be diluted with a greater or less quantity of water; after which, the linen, meant to be washed, is to be steeped therein, to be rubbed, and wrung, in the usual way.

Observations.

1. It is better that the ley should not be made until the time when it is to be used: if it is left to stand in open vessels, its power is weakened, and its nature is changed.

2. Fresh wood ashes are preferable to old ones, particularly if the latter have been exposed to the air; in that case, they have no longer their usual power,

to my former work, instructing them how to prepare, as a substitute for soft soap, (which is at present made use

and we must, in order to make them serve our purpose, mix with them a greater proportion of quick-lime.

3. Those ashes also are preferable which are produced from hard wood: those which are left after the burning of floated wood cannot be made use of with equal success.

4. Fat oils, of a thick consistence, are most proper for the purpose here spoken of: fine thin oils are by no means fit for it.

5. If stinking oil be made use of, it is apt to give a bad smell to the linen; this may be removed by passing the linen carefully through a strong pure ley; but, in general, this smell goes off as the linen becomes dry.

6. When the mixture of oil with the ley is of a yellow colour, it must be diluted with water.

7. When the oil rises in the ley, and swims upon the surface of it, in the form of small drops, it shows that the oil is not fit for the purpose, not being thick enough; or else, that the ley is too strong, or not sufficiently caustic.

8. To prevent the quick-lime from losing its power, and that we may always have some to use when we want it, it may be broken into small pieces, and kept in bottles well dried, and well corked.

Second Method.

Floated wood, which is made use of in many parts of France, produces ashes which contain very little alkaline salt, and which are consequently very improper for making leys; in that case, barilla, or potash, may be used instead of them.

Take barilla, and break it into pieces about the size of a walnut; put these into a vessel of any kind, and pour upon them twenty times their weight of water: the water is to be left upon the barilla till it appears, by putting a little upon the tongue, to be slightly salt.

Some oil is then to be put into an earthen vessel, and forty times as much of the barilla ley is to be poured upon it: the mixture, which soon becomes milky, is to be well shaken, or stirred; and, after being diluted with more or less clean water, according to its strength, and the purpose for which it is intended, is to be made use of like a solution of soap in water.

Instead of barilla, potash may be employed, but it requires a small quantity of pounded quick-lime to be mixed with it.

Observations.

1. Alicant or Carthagena barilla may be used without any mixture of lime; but the bad barilla of our country requires to have mixed with it a greater or less proportion of lime, according to its degree of strength and purity.

2. When barilla, of whatever kind it be, is in a state of efflorescence, it cannot be employed without a mixture of lime.

of in fulling almost every kind of woollen stuff,) a kind of soap which costs little, and which may be easily made in every woollen manufactory.

In all manufactories of cloth, blankets, and other woollen goods, it is the custom to full the stuff, as soon as it comes from the loom. The intention of this operation is, not only to scour the cloth, &c. but also to render it more compact; and, in performing it, about thirty pounds of soft soap are used to eighty pounds of woollen stuff. In the south of France, before the revolution, soft soap cost twenty livres the hundred weight. A great part of our oil, and also of that of Italy, is consumed in making it; so also are the wood ashes of the fires used for domestic purposes, in those countries where it is made.

From what has been said, it is obvious how advantageous it would be to the manufacturer, and to commerce in general, to be able to supply conveniently the place of soft soap, by an article, the preparation of which is neither difficult nor expensive. Besides the saving which would take place in the manufacturing of woollen goods, great advantage would arise from the ashes of our wood fires being left, either for domestic uses, or for salt works, or for manufactories of green glass; and, at the same time, the oil now used in making soap would remain, to be wholly employed in purposes wherein it is impossible to find a substitute for it.

3. If the barilla ley is too strong, the oil is apt to swim on its surface; it must then be diluted with a proper quantity of water.

4. Fat oil is most fit for this purpose: fine light oils should not be used.

5. When the saponaceous liquor is greasy, and the linens washed in it are so likewise, they must be passed through a pure barilla-ley, to have their greasiness removed; which ley should first be warmed a little, to encrease its effect.

6. When the water which was poured upon the barilla is all used, fresh water may be poured upon the remaining barilla. This water will acquire a saline taste, like the first: thus, the same barilla may serve for several successive operations.

In all times, both the manufacturer and the government have sought how to get rid of the above mentioned inconveniences. Fullers earth, pure alkalies, and other things, have by turns been made use of. The first performs the operations of bleaching and fulling very imperfectly: the second dissolve the cloth; and the manufacturers of Lodeve still recollect, with terror, a quack sent there by the government, some years ago, who proposed to make use of mineral alkali or barilla, instead of soap.

To the inconveniences already mentioned we may add, that instead of rendering the cloth sufficiently soft and pliable, the substitutes just spoken of leave it in a degree of harshness, which nothing but soap completely removes. It is necessary, therefore, that any substance proposed to be used, instead of soft soap, should possess the power of scouring, of fulling, and of softening, the cloth. The composition which I am now about to describe unites all these advantages: experiments have, by my desire, been made with it, at Lodeve, by M. Michael Fabriguette; a person as well versed in philosophical pursuits as in manufacturing of cloth.

The whole process consists in making a caustic alkaline ley or lixivium, with wood ashes or potash; in causing the ley to boil; and then dissolving therein as great a quantity of old woollen rags, or shreds of cloth, as the ley will dissolve. By this means a kind of soft soap is produced, of a greyish-green colour, the ingredients of which are well combined with each other, and which is very soluble in water. It has an animal smell; which, however, the cloths get rid of, by being washed, and exposed to the air.

The various experiments I have made on this subject have been attended with the following results.

1. As soon as the wool is thrown into the boiling ley, its fibres adhere to each other, and a very slight de-

gree of agitation is sufficient to render its solution complete.

2. In proportion as fresh wool is added, the ley gradually acquires colour and consistence.

3. The soap has more or less colour, in proportion to the cleanness and whiteness of the wool made use of.

4. Hair of a coarser kind, which happens to be mixed with the old wool, is dissolved with more difficulty.

5. The quantity of wool which the ley is capable of dissolving depends upon its strength, its causticity, and its degree of heat. Two pounds, three ounces and three quarters, of caustic alkaline ley, at twelve degrees of concentration, and at the boiling heat, dissolved ten ounces and a half of wool. The soap, when cold, weighed one pound four ounces.

A similar quantity of alkaline ley, of the same degree of causticity and heat, in which I dissolved four ounces of wool, did not thereby acquire sufficient consistence to be capable of being used for the various purposes for which this soap is intended.

Another similar quantity of ley, of four degrees of concentration, could not dissolve more than two ounces and seven drams of wool. The soap was of a good consistence, and, when cold, weighed fourteen ounces.

6. In proportion as the wool is dissolved in the ley, the solvent power of the alkali grows weak, and at last it will dissolve no more. When we observe that the wool, upon being stirred in the liquor, is no longer dissolved, it is then time to stop the process.

I shall now point out what means are to be employed, in every woollen manufactory, to prepare the soap which will be wanted in it.

On the Choice and Preparation of the Materials.

The materials requisite to form this soap are only two; alkaline substances, and wool.

The alkaline substances may be procured from the ashes of any fires where wood is burnt; and the ley is to be made according to the common well known process. Quicklime is to be slaked with a small quantity of water, and the paste formed thereby is to be mixed with the ashes, (they being first passed through a sieve,) in the proportion of one tenth part of quicklime, by weight, to the quantity of ashes made use of. The mixture should be put into a stone vessel; (as wooden vessels not only colour the ley, but are themselves much injured by it;) and water is then to be poured upon it, in such quantity as to cover it, and rise some inches above it. These are to be left together for a certain time, and then the ley is to be drawn off, by an aperture, made for that purpose, at the bottom of the vessel. It is best not to draw off the ley, till the moment when it is to be used: its strength should be from four to fifteen degrees; but the degree of concentration is a matter of very little consequence, since all the difference that results from making use of a weak ley or a strong one, is, that a greater or less quantity of wool will be dissolved.

The potash of commerce may also be made use of; it is to be employed in the same manner as the wood ashes, but with one third of its weight of quicklime.

With respect to the choice of the wool, every one knows, that in the making of woollen cloths, blankets, and all other kinds of woollen goods, a series of operations are performed, from the first washing of the wool to the finishing of the cloth, &c. in each of which there occurs a loss, more or less considerable, of a portion of the original material. The water in which the wool is

washed, the floor on which it is spread, and the warehouse in which it is deposited, exhibit sufficient proofs of this; so also do the operations of beating, carding, spinning, and weaving the wool, and those of shearing, combing, and fulling the cloth. It is indeed true that the scattered wool, produced from these various processes, is collected with some care; but many of them are of such a nature, that the waste wool resulting from them, either is dirty, and mixed with other substances, or it is cut so short, that it is rendered incapable of being again used: in either case, the manufacturer throws it on the dunghill. The making of the soap here described furnishes him with the means of bringing all these into use; nothing more being requisite than to collect them in the baskets in which the wool is washed, and to wash them carefully; as well for the sake of cleaning them, as to separate from them all foreign substances. When washed, they may be laid by till wanted.

We may also, with equal advantage, make use of the cuttings and shreds of woollen cloth, which are found in the shops of woollen drapers, tailors, &c. and likewise of all sorts of garments, or other woollen articles, after they have been worn till they will serve no longer.

On the Preparation of the Soap.

When the ley is made, and the wool procured, nothing remains to be done, but to bring the ley to a boiling heat in a common caldron. When it is brought to that degree of heat, the wool is to be thrown in, a little at a time, and the mixture is to be stirred, that the solution may go on the faster. A fresh quantity of wool should not be added, until the preceding quantity is dissolved; and the process should be stopped, as soon as we find that the liquor will not dissolve any more wool.

It has been ascertained, by trials in the large way, made by Michael Fabriguette, with soap of this kind, which he prepared according to my instructions, that such soap scours the cloths, felts them, and softens them, perfectly well; but there are some observations to be made, respecting its use, which are too important to be omitted.

First, when this soap is not prepared with sufficient care, or when it is made with dirty or coloured wool, it is apt to give the cloths, &c. a greyish tinge, which it is very difficult to remove. If the cloth is intended to be dyed, this tinge is of no consequence; but it would injure that fine white colour, which, in certain cases, is intended to be given, or to be preserved. This tinge, however, may be prevented, by a very careful selection of the materials for making the soap which is meant to be employed for such delicate purposes.

Cloths, &c. fulled with this soap, acquire, as was said before, an animal smell, which, without being very strong, is nevertheless unpleasant; but, water and air never fail to remove it.

Having succeeded in fulling woollen cloths by the use of this soap, I attempted to use soda, in the place of potash, and thus to form (according to the process above described) a hard soap, fit for the operations of dyeing cottons; and my experiments succeeded beyond my expectations.

Forty-six pounds of soda ley (of eight degrees) dissolved, in a boiling heat, five pounds of wool; and afforded, when cold, sixteen pounds fourteen ounces of soap, sufficiently hard to keep its form.

The first quantities of wool thrown into the soda ley are easily dissolved; but it may be observed, that the liquor gradually grows thicker, and that the dissolution becomes more difficult and slower.

The ley, by the wool first dissolved in it, acquires a green colour; it afterwards grows black; and the soap, when cold, still retains a blackish green colour.

This soap has been made use of, in every different manner, and under every form, in my manufactory for dyeing cottons; and I am now satisfied that it may be employed, instead of the saponaceous liquor we are accustomed to make from ley of soda and oil, for the purpose of preparing the cottons. I have constantly observed, that if such a quantity of this soap be dissolved in cold water as will render the water milky, and the cotton be worked therein, in the usual well known manner, it will, by being passed three times through the liquor, and dried each time, be as strongly disposed to receive the dye, as cotton which has been seven times passed through the saponaceous liquors commonly used. This will not be thought very astonishing, when it is considered, that animal substances are very fit for disposing thread and cotton to receive the colours with which they are to be dyed; and that the intention of several of the operations to be performed upon them, previous to their being dyed, is merely to impregnate them with such substances.

It is necessary to remark, that cotton, by being passed through a solution of this soap, acquires a grey tinge, very much like that which is given to it by aluming; although the common saponaceous liquors give it a beautiful white colour. This grey colour, however, is no disadvantage to cotton which is intended to be dyed, as we have already remarked with respect to woollen cloths.

In confirmation of what I have said above, respecting the advantage to be derived from making use of this soap, I may add, that after having impregnated some cotton with it, according to the usual method, I made it pass through all the processes which wool undergoes, in order to be dyed of a scarlet colour. The consequence was,

that the cotton was thereby dyed of a deep and very agreeable flesh colour; whereas, cotton which had not been prepared in that manner, came out of the bath almost of its natural colour. This first trial promises advantages which I mean to pursue.

It may be right to observe, that this soap of wool may advantageously be made use of, instead of common soap, for domestic purposes. I have employed it, with the greatest success, in washing linen; and it is particularly efficacious in scouring woollen garments, &c. I have no doubt that the facility and economy with which its preparation is attended, will cause its use to be extended to many other purposes; in the mean time, I thought it right to give an account of the various ways in which I have applied it.

I shall only add, that as the soap here described gives to woollens and cottons a grey tinge, which is very difficult to remove, it follows that it cannot be used for washing linen, unless it be made of white wool, carefully selected, and well washed.

No. 16.

Specification of the Patent granted to Mr. GEORGE CUMMINGS, *of Ludgate street, London, Toyman; for his Invention of a Composition to put on all Sorts of Skins, Paper, or Linen, for drawing or writing on with Pen and Ink, or Pencil, and rubbing clean off again.**

Dated March 31, 1764.—Term expired.

TO all to whom these presents shall come, &c. Now know ye that, in compliance with the said proviso, I the said George Cummings do hereby declare, that my said

* Repertory, vol. 7, p. 231.—This is what was called *German asses-skin.*

invention of a composition to put on all sorts of skins, paper, or linen, for the use of drawing or writing on with pen and ink, or pencil, and rubbing clean off again, and to form it into a memorandum book, distinguished by putting the name of each day of the week on the top of each leaf of the book, and for other uses and purposes, is to be performed in manner following; that is to say, take either vellum, parchment, very fine cloth, or paper, and stretch it in a frame as tight as possible. Then take twelve pounds of white lead, and pound it very fine; add thereto one third part of the best plaister of Paris, and one-fourth part of the best stone lime; pound them well, mix them well together, and grind them very fine with water. Then take a new glazed vessel, and dissolve six or seven pounds of the best double size, over a fire, and mix the above ingredients in this, till it is of such a consistence as to lay on with a brush. Then lay three or four layers on the skin or cloth, as smooth as possible; observing that the skin is dry each time, before a second layer is put on. Then take the best nut or linseed oil, and to every pound of this oil add four ounces of the best white varnish, and mix them well together. Then put on three or four layers of this oil, thus prepared, each time exposing it to the air till it is thoroughly dry: this is for the white sort. For a brown or yellow, add to every pound of the above, three or four ounces of the best stone oker, or orpiment, or Dutch pink, and three or four ounces of litharge. These must be well ground with very old linseed oil, and laid on, as smooth as possible, ten or twelve times; exposing it each time to the air, to be thoroughly dry, before a second layer is put on: observe you do not put it where any dust or dirt can fall upon it. It may be, by the same process, altered to any colour: as for instance; to a red, by tincturing it with vermilion, or the like; to a blue, Prussian blue; and for a black, by pound-

ing slate, grinding it very fine, and mixing with it as much ivory-black as will turn it to a fine black colour. When it is thoroughly dry, you may write on it with a slate pencil, or black or red lead. In witness whereof, &c.

No. 17.

*List of English Patents.**

(Continued from vol. 1, page 480.)

1797.

John Manton, April 12, invention or improvement in the construction of guns and pistols.

Rob. Cross, April 26, a new invented tan-pit, and mode of tanning.

T. Todd, May 9, an hydraulic pump or machine for raising water.

Richard Varley, May 29, a perpetual moving-power.

Timothy Harris, July 4, method of manufacturing pins, with iron and other metals, and making the same white.

Joseph Slater, July 4, improvement in a machine for finishing bleached, dyed, and printed muslins.

Anthony George Eckhardt, July 4, method of making draw or bench looms, for manufacturing carpets, borders, and other things.

John Hawksley, July 4, method of combing wool, cotton, silk, flax, hemp, and mohair.

John Maule, July 4, improvement on a machine for cleaning grain from the straw.

John Richardson, July 4, machine to be applied to glasses and pebbles of every description, for the use of sights in general.

Henry Johnson, July 7, a water-proof compound, and a vegetable liquid for bleaching, whitening, and cleansing woollens, linens, cottons, &c. and also for preparing stuffs or cloths made of wool, linen, cotton, or silk, in order, by the application of the aforesaid water-proof compound, to render them impenetrable to wet.

Archibald, earl of Dundonald, Aug. 16, method of preparing ceruse, or white lead, which he conceives will be of great public utility, particularly as he has reason to believe it will not be injurious to the health of persons employed therein.

Anthony George Eckhardt, Aug. 18, method of constructing

* Repertory, vol. viii.

pumps and engines for evacuating water or other fluids, extinguishing fires, &c.

William Chapman, Sept. 13, method of laying, twisting, or making ropes or cordage, of any number of yarns or strands, or any number of threads, tarred or untarred.

Samuel Stanfield, Sept. 13, machine for roving or spinning of cotton, flax, hemp, worsted, yarn, wool, &c. and for doubling and twisting silk, cotton, and thread.

Charles Baker, Oct. 11, method of preventing the smut in wheat.

Edmund Cartwright, Oct. 11, an incombustible substitute for certain materials commonly used in constructing dwelling-houses and other buildings.

Harry Watts, Oct. 19, implement for draining land.

Joseph Bramah, Oct. 31, method of retaining, clarifying, preserving, and drawing off all kinds of liquors; with sundry improved casks, and implements, necessary to give his contrivance the full effect.

John Harriott, Oct. 31, new invented cog-wheel crab, or capstan, with geers, to work ships' pumps, engines, and hydraulic machines, to give a ship way through the water, in calms or light winds.

Thomas Paton, Oct. 31, new invented press.

John Parrish, Oct. 31, method of rendering all kinds of woollen cloth impenetrable to moisture or wet, or water-proof, without affecting their beauty, colour, or wear.

Robert Beatson, Oct. 31, method of applying the power of wind or water to horizontal mills, the principle of which may be also applied to several other purposes.

Henry Overend, Nov. 9, machine which may be used as a waggon, cart, or dray, in a more perfect and expeditious manner, and with fewer horses, than usually and heretofore done.

Edmund Cartwright, Nov. 11, improvements in the construction, working, and application of steam engines.

Daniel Langton, Nov. 18, locks, springs, and machinery, for the security of doors, and for preventing rain or wet from passing under them, and which will cause doors to pass over carpets, &c. and will prevent cold air from passing under or over the same, and, by that means, keep rooms warm.

John Crooks, Dec. 12, method of making soap, and bleaching, by means and use of mineral and vegetable alkalies.

James Weldon, Dec. 22, machine or mill for breaking, grinding, and pulverising, patched or chopped bark, for tanning; and for breaking, grinding, and pulverising, different kinds of wood, and other hard substances.

William Milton, Dec. 23, method of causing ships, vessels, barges, boats, and craft of all sizes, to be built at prices considerably below what are given for them, as built in the present mode; and for rendering the rudders thereof, in some cases, more effectual.

Matthew Boulton, Dec. 30, apparatus and method of raising water and other fluids.

1798.

Anthony George Eckhardt, Jan. 16, method of making chairs, stools, benches, &c. adapted for rooms or carriages, with backs or seats and cushions fixed in such a manner as instantly to change, and show two different surfaces in one seat or cushion.

Samuel Roberts, Jan. 23, working, adjusting, supporting, and fixing, slide-tube candlesticks of silver, silver plated, or other metal.

Charles Tennant, Jan. 23, method of using calcareous earth, and the earths strontites and barytes, instead of alkaline substances, for neutralizing the muriatic acid gas used in bleaching; and for employing those earths in the other parts of the process of bleaching, instead of alkaline substances.

Archibald, earl of Dundonald, Jan. 25, method of manufacturing and procuring certain neutral salts, substances, and things, and of applying those and other neutral salts to valuable purposes.

Richard Shannon, Feb. 1, method of improving the processes of brewing, distilling, boiling, evaporating, and of raising, and condensing, steam or vapour, from aqueous, spirituous, saccharine, and saline fluids.

Henry Clay, Feb. 1, method of saving part of the water now lost, in passing boats and barges through locks on navigable canals.

Robert Howden, Feb. 10, portable and moving furnace, for the purpose of heating ovens of every description.

Francis Farquharson, Feb. 20, machinery for making bricks and tiles.

James Douglas, Feb. 20, machine for making bricks.

Walter Taylor, Feb. 21, improvement in the construction of machines for raising water, and clearing ships of the same; also to take off the pressure of the atmosphere, or eddy winds, from the tops of chimnies, to prevent what are commonly called smoky chimnies.

(To be continued.)

Hydraulic Ram.

The hydraulic ram of M. Mongolfier has been constructed at Schaffhausen by counsellor Fischer in a very ingenious manner. The machine has the form of a beautiful antique altar, nearly in the style of that of Esculapius, as represented in different engravings. A bason about six inches in depth and from eighteen to twenty in diameter receives the water, which enters into pipes three inches in diameter, that descend in a spiral form into the base of the altar. The water by its weight puts in motion a valve; a third nearly of the water escapes, but the rest by the pressure of the valve is forced into the receiver, and thence rises in very narrow pipes. As it ascends slowly the resistance of the air makes no sensible impression, so that by means of this machine, which continually acts by itself, water may be conveyed from a lake or a river to houses situated on a mountain. M. Fischer has conveyed water by it to a castle which stands at the height of several hundred feet above the level of the Rhine. *Tilloch*, vol. 20.

Water-proof Cloth.

It is well known that for some years past several methods have been tried to render cloth impermeable to water, and the inventors of this process have kept the discovery a mystery. There was, however, reason to suppose that some fat oil made the basis of their recipes. A bottle of this liquor, the efficacy of which was known, having fallen by chance into the hands of M. Vauquelin, he was desirous to discover the composition of it. The following is the manner in which this chemist thinks it is composed, bating the proportions. Soap and strong glue, or any other gelatin, are dissolved in water. With this solution is mixed a solution of alum, which, being decomposed, forms in it a flaky precipitate, composed of oil, alumine, and animal matter. Weak sulphuric acid is then added, to redissolve a part of the alumine, and to render the precipitate lighter, and to prevent it from falling to the bottom. But the alumine, when once combined with the oil and animal matter, does not redissolve entirely in the sulphuric acid; for this reason the oil always remains very opake, and neither rises nor is precipitated. It may readily be conceived, that too large a quantity of sulphuric acid must not be added. M. Vauquelin does not know whether this be exactly the process, but by following it he has been able to obtain a similar liquid, which possesses the same properties. *Ibid.*

D. Edwin sc.

David Rittenhouse.

Born April 8th 1732. Died June 26th 1796.